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# Investigating the Anatomy of the Employment Effects of New Business Formation

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**Abstract**

Recent empirical research has found that the effect of new business formation on employment emerges over a period of about ten years and has identified a 'wave' pattern of these effects. In this study, we decompose the overall contribution of new business formation on employment change into direct and indirect effects. The results indicate that indirect effects of new business formation are quantitatively much more important than the direct effects. Furthermore, we find that regional differences of the employment change generated by new business formation can to a large part be explained by respective differences of the indirect effects. Hence, the interaction of the start-ups with their regional environment plays a great role for explaining their impact on regional development.

JEL classification: L26, M13, O1, O18, R11

Keywords: Entrepreneurship, new business formation, regional development, direct and indirect effects

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## 1. Introduction[1]

Recent empirical research has found that the effect of new business formation on employment emerges over a longer period of time. A typical 'wave' pattern of these effects over time has been identified, which suggests different phases of this process (see Fritsch, 2008, for an overview). One main implication of this wave pattern is that the new businesses have pronounced indirect effects on the employment in the incumbents and that these indirect effects are positive in the long run. The wave pattern also suggests that the indirect employment effects of new business formation are considerably more pronounced than the employment that is generated by the newcomers. Empirical analyses have also shown that there may be considerable differences with regard to the form of the wave pattern in different types of regions. The reasons for these regional differences have, however, remained rather unclear. In particular, we do not know to what extent these differences are caused by respective differences in the development of the new businesses or by varying magnitudes of the indirect effects?

This paper attempts to shed some light on the anatomy of the wave pattern and on the regional differences of the employment effects of new businesses that have been found for different types of regions. We will decompose the overall employment effect of new business formation into two components. One of these components is the direct employment effect which is the contribution of employment in the new businesses to overall employment change. The other component is the total indirect effect, i.e. the employment change that the start-ups induce in the incumbent businesses in the respective region. Based on this decomposition, we estimate the extent of the different effects in order to assess which of the two components contributes the larger share to overall employment change. We will execute this decomposition also for different types of regions and investigate in how far the diverging patterns that have been found in previous analyses are caused by the direct and by the indirect effects.

[1] We are indebted to David Storey for comments on an earlier version of this paper.

Our analysis clearly shows that the indirect effects of new business formation are responsible for the largest part of the overall employment effect. Moreover, we find that the regional differences between agglomerations, moderately congested areas, and rural regions are almost entirely caused by these indirect effects. These findings have important implications for further empirical analyses as well as for policy. The important role of the indirect effects of new business formation on employment suggests that research that tries to assess these effects by investigating the development of the newcomers is not very relevant. For policy directed to new business formation, this result poses the question about the forces that determine the magnitude of the indirect effects and how large, positive indirect effects of new business formation on employment could be stimulated and safeguarded.

The next section (section 2) introduces the results of recent empirical analyses of the effects of new business formation on employment and provides an interpretation of the wave pattern that has been found. The data that are used in the empirical analysis are described in section 3. We then compare the pattern and the extent that the different effects of new business formation have on employment over time (section 4). Section 5 reports the results of this decomposition for agglomerations, for moderately congested areas, and for rural regions and compares the patterns that we find for these types of regions. Section 6 concludes.

## 2. Direct and indirect effects of new business formation on regional employment change

### 2.1 The wave pattern

It has become common practice to analyze the effects of new business formation on employment at a regional level because an analysis at the level of industries leads to serious difficulties in the interpretation of the results. The reason is that if industries follow a life cycle, then the number of entries and the start-up rate will be relatively high in the early stages of the life cycle when the industry is growing, and it will be relatively low in latter stages in

which the industry declines (Klepper, 1996). Obviously, the resulting positive correlation between the start-up rate and the development of industry employment in subsequent periods may be considerably shaped by the industry life cycle and cannot be unambiguously regarded as an effect of entry on development. Entirely different results are found if the relationship between the level of start-ups and subsequent employment change is analyzed on the level of regions and on the level of industries (see Fritsch, 1996). Therefore, geographical units of observation are much better suited than industries for such an analysis.

The studies that analyzed the relationship between the level of new business formation and regional employment change with no or with only relatively short time-lags arrived at rather mixed results (see Caree and Thurik, 2004, and Fritsch, 2008, for an overview). A main reason for this unclear evidence was obviously because not all the effects of new business formation on employment emerge immediately at the time when the newcomers enter the market but become observable only with a considerable time-lag. In an analysis for West German regions, Audretsch and Fritsch (2002) did, indeed, find support for long-term effects of new business formation. This result was confirmed by van Stel and Storey (2004) who analyzed the relevance of such time-lags more systematically and estimated a time-lag structure of the effects of new business formation on regional employment growth with data for Great Britain.

A severe problem in such an analysis of the lag structure emerges from a high correlation between yearly start-up rates. Due to such a high correlation, the original estimates may not reflect the ‘true’ lag structure. In dealing with this problem, van Stel and Storey (2004) applied the Almon polynomial lag procedure. This procedure attempts to approximate the lag structure by a polynomial function (Greene, 2003). In this type of analysis, an assumption has to be made about the order of the polynomial to be used for estimating the lag structure. Fritsch and Mueller (2004, 2008) applied the Almon polynomial lag procedure in an analysis of the effect of new business formation on regional development in West Germany. They found that a statistically significant effect of new business formation on employment is

restricted to a period of about ten years. According to Fritsch and Mueller (2004, 2008), the lag structure shows a 'wave' pattern as displayed in figure 1. This figure depicts the original regression coefficients that have been found without application of the Almon lag procedure as well as the coefficients that result from this procedure by assuming a third-order polynomial. The resulting smoothened lag structure suggests that new business formation during the current year has a positive impact on employment change. For years t-1 to t-5, the effect is negative with a minimum in t-3. For the entries in years t-6 to t-9, a positive relationship is found with a maximum between years t-7 and t-8. The magnitude of the effect then decreases and becomes slightly negative in the last year of the sample (t-10). This type of lag structure of the effects of new business formation on employment growth has been confirmed in a number of empirical analyses for other countries.[2]

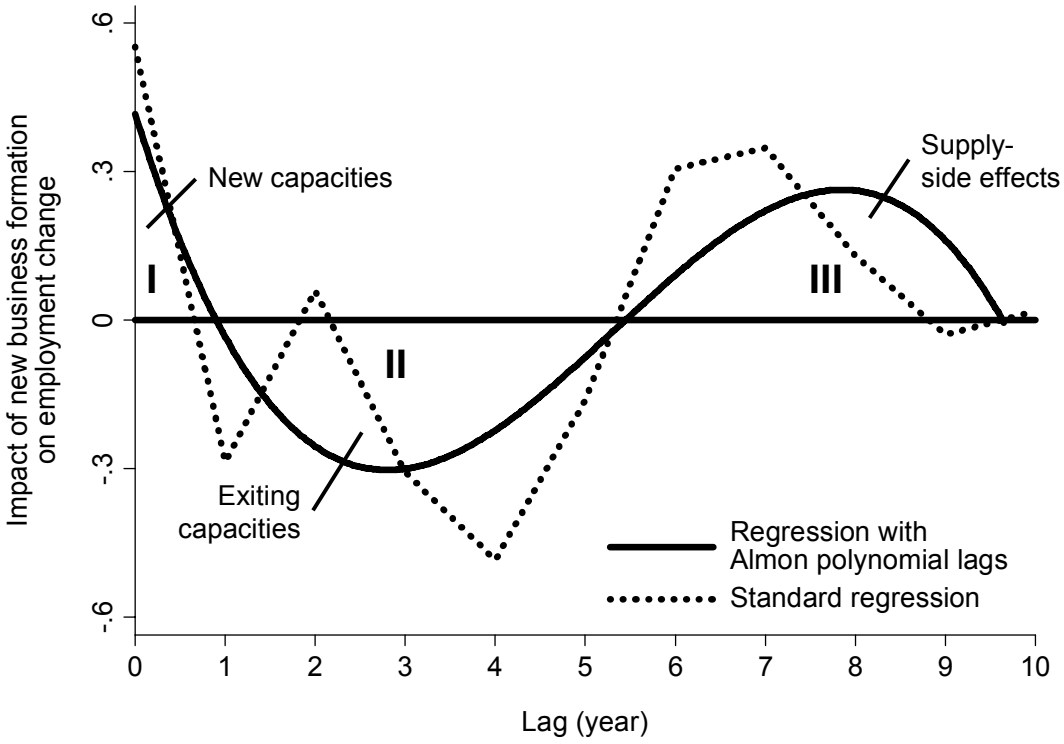



*Figure 1:* The effects of new business formation on employment change over time in West Germany

[2] Acs and Mueller (2008); Andersson and Noseleit (2009); Arauzo-Carod, Liviano-Solis, and Martin-Bofarull (2008); Baptista, Escária, and Madruga (2008); Carree and Thurik (2008); Dejardin (2009); Mueller, van Stel, and Storey (2008); van Stel and Suddle (2008).

Fritsch and Mueller (2004) suggest the following interpretation of this wave pattern. They argue that new businesses represent an entry of new capacities into the market and have a direct effect as well as indirect effects. The *direct effect* of new business formation is given by the evolution of the newcomers, e.g. the number of their employees or their market share. According to Fritsch and Mueller (2004), the positive employment impact for start-ups in the current year can be understood as the additional jobs that are created in the newly founded businesses at the time of inception (area I in figure 1). This direct employment effect is, however, only a part of the contribution that the new businesses make to economic development. Indirect effects emerge because the new businesses challenge the incumbents and are subject to competition and market selection.[3] Due to this market selection, only a fraction of the start-ups will survive for a longer period of time and those which do succeed in establishing themselves in the market may displace incumbents. Given that market selection works according to a survival of the fittest scenario, firms with relatively high productivity will remain in the market while those with low productivity have to reduce their output or exit.[4] At a constant output level, this market selection process should lead to a decline in employment, not to new jobs, because fewer resources are needed in order to produce the given amount of goods and services at a higher productivity level. Hence, the negative impact of the start-ups in years t-1 to t-5 (area II in figure 1) is probably a result of *exiting capacities*, i.e. new businesses that fail to be competitive and the displacement of incumbents.

According to Fritsch and Mueller (2004), the positive impact of new business formation in the years t-6 to t-10 on employment (area III in figure 1) is probably due to a dominance of increased competitiveness of the regional

[3] It is well known from a number of analyses that employment in entry cohorts tends to be stagnant or decline from the second or the third year onward (Boeri and Cramer, 1992; Brixy and Grotz, 2004; Fritsch and Weyh, 2006). Therefore, new firm formation activity in year t-3 and more distant time periods should not lead to any significant direct employment effects.

[4] Crowding-out effects may occur in the output market because the entrants gain market share as well as in the input market due to the additional demand of the new businesses for resources that can lead to scarcity of inputs and increasing factor prices.

suppliers resulting from enhanced productivity. This can be labeled the *indirect supply-side effect*. Such supply-side effects of entry could consist of (see Fritsch, 2008, for a more detailed exposition):

- *securing efficiency and stimulating productivity* increase by contesting established market positions,
- an *acceleration of structural change* by a turnover of economic units,
- *amplified innovation,* particularly the creation of new markets, and
- *greater variety* of products and problem solutions.

The indirect supply-side effects are the main reason why one should expect positive employment effects of new business formation. They are not necessarily limited to the industry to which the start-up belongs, but rather may also occur in completely different industries that use the improved supply as an input. They also do not have to be limited to the region in which the entry occurs but can also emerge in other regions. After about nine or ten years, the impact of new business formation on regional employment has then faded away.

Summarizing, we can say that the empirical evidence suggests that the process of creative destruction that is initiated by the entry of new businesses occurs in different phases. Although these three phases may overlap in time, there are certain periods after market entry in which a certain phase dominates the overall development. The first effect is the generation of additional employment due to the creation of new businesses which occurs at about the time the new entities are set up. It is followed by a second phase in which inefficient suppliers have to exit, leading to a decline in employment. If market selection works according to a survival of the fittest scenario this second phase should be characterized by an increase in productivity that leads to improved competitiveness. In a third phase which starts to dominate the development about five to six years after market entry, this increased competitiveness may lead to more employment.

## 2.2 Regional differences

Some of the recent studies have found severe differences in the effects of new business formation on employment between certain types of regions, particularly between high density and low density areas (Fritsch and Mueller, 2004, 2008; Fritsch and Schroeter, 2009; Mueller, van Stel, and Storey 2008; van Stel and Suddle, 2008). According to Fritsch and Mueller (2004, 2008), the effects of start-ups on employment are much more pronounced in the West German agglomerations and moderately congested areas than in rural regions in all three phases of the wave (figure 2). They found that the overall effect of new businesses on employment was highest in the agglomerations[5], particularly due to stronger positive effects in the third phase of the wave that is presumably dominated by supply-side effects. A similar result has been attained by van Stel and Suddle (2008) who compared the employment effects of new business formation between the urban und the rural regions of the Netherlands. While the curve for the urban areas indicated a pronounced positive effect, the impact of start-ups in the rural regions was negative.[6]

The relatively strong positive long-term employment effect of start-ups in agglomerations may be explained by a correspondingly high degree of competition in these areas, facilitating the selection process and stimulating the performance of surviving firms. A higher level of competition in agglomerations directly results from the high density of businesses in an area, i.e. more firms demanding similar inputs or supplying goods and services on the same market. The conjecture of a relatively high intensity of competition in agglomerations is supported by empirical analyses that find a

[5] Fritsch and Mueller (2008) also identified considerable differences between regions with a relatively high level and a low level of labor productivity, but Fritsch and Schroeter (2009) did not find any statistically significant influence of regional labor productivity on the employment effects of start-ups.

[6] Negative overall effects of new business formation on employment have also been found by Mueller, van Stel, and Storey (2008) for Scotland and Wales as well as for those regions of Great Britain that are characterized by a rather low start-up rate.

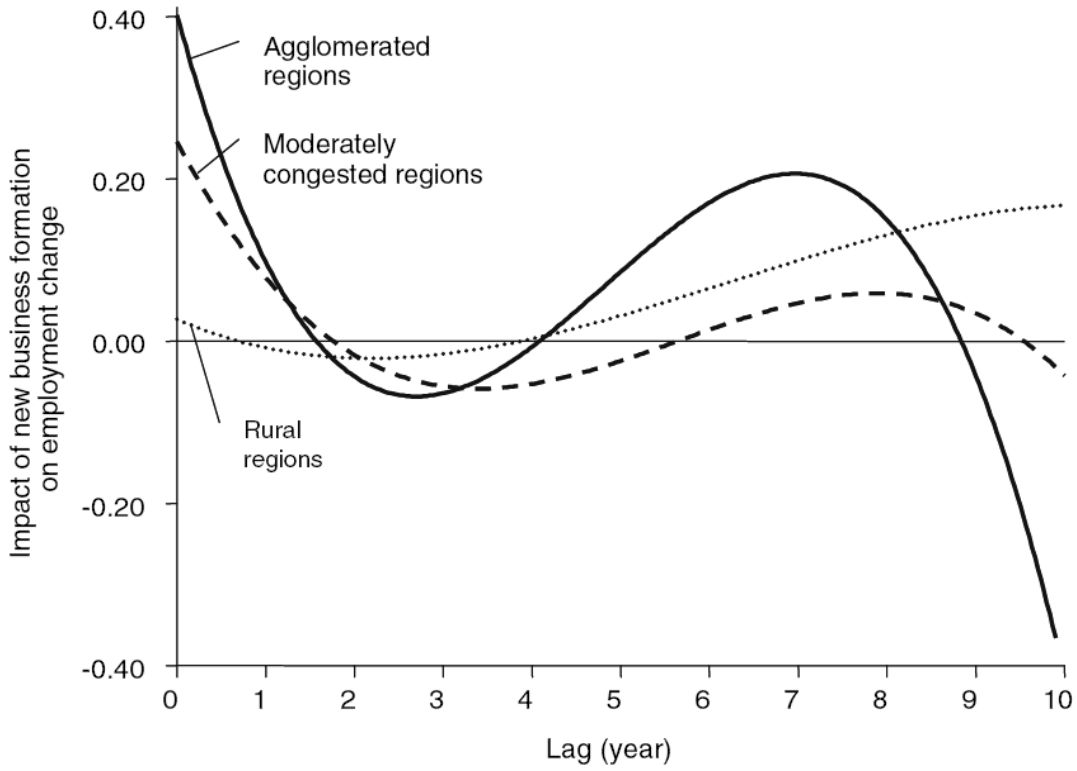



Figure 2: The structure of the impact of new business formation on regional employment change in agglomerations, moderately congested regions, and rural regions (Fritsch and Mueller, 2008)

higher level of new business formation (Acs,Bosma and Sternberg, 2008) but a lower probability of survival (Engel and Metzger, 2006; Weyh, 2006) in these areas. Another explanation for a stronger effect of new business formation on developments in the agglomerations could be based on the observation that the share of start-ups in knowledge-intensive industries and in high-tech industries tends to be relatively high in the agglomerations and relatively low in rural areas (Audretsch, Keilbach, and Lehmann, 2006, 87-90; Bade and Nerlinger, 2000). Assuming that knowledge-intensive or innovative start-ups impose a greater challenge on incumbent firms than non-innovative start-ups, the higher share of such new businesses in agglomerations may be responsible for the more pronounced effects of new business formation in these regions.

## 3. Data and spatial framework of analysis

Our data on start-ups, on employment in start-ups, and on overall employment are derived from the establishment file of the German Social Insurance Statistics (*Betriebsdatei der Statistik der sozialversicherungspflichtig Beschäftigten*)[7]. This database allows us to follow the employment in cohorts of newly founded businesses over time. The data are currently available for the 1984-2002 period. Other data are also taken from this source or are provided by the statistical offices.

The spatial framework of our analysis is based on the planning regions (*Raumordnungsregionen*) of West Germany. Planning regions consist of at least one core city and the surrounding areas. Therefore, the advantage of planning regions in comparison to districts (*Kreise*) is that they can be regarded as functional units in the sense of traveling / travel to work areas thereby accounting 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 (see Federal Office for Building and Regional Planning, 2003, for the definition of planning regions and districts).

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 currently available time series for East Germany is much shorter beginning in 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 this region after the reunification of Germany in 1990. For administrative reasons, the cities of Hamburg and Bremen are defined as

[7] See Fritsch and Brixy (2004) for a description. This database includes information on all establishments that have at least one employee subject to obligatory social insurance – therefore only owner managed businesses without any other employees are excluded. The public sector is excluded from our analysis.

planning regions even though they are not functional economic units. In order to avoid possible distortions, we merged these cities with adjacent planning regions.[8] Therefore, we have 71 regions in our sample.

The start-up rate is calculated according to the so-called labor market approach; namely, the number of start-ups per period is divided by the number of persons in the regional workforce (in thousands) at the beginning of the respective period. An adjustment was made to control for the fact that not only the composition of industries differs considerably across regions but that the relative importance of start-ups and incumbent enterprises also varies systematically across 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 entrepreneurship in regions with a high composition of industries where start-ups play an important role and underestimating the role of new business formation in regions with a high share of industries where the start-up rates are relatively low. To correct for the confounding effect of the regional composition of industries on the number of start-ups, a shift-share procedure was employed to obtain a sector-adjusted measure of start-up activity (see the Appendix of Audretsch and Fritsch, 2002, for details). This sector adjusted number of start-ups is defined as the number of new businesses in a region that could be expected if the composition of industries were identical across all regions. Thus, the measure adjusts the raw data by imposing the same composition of industries upon each region.[9]

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

[9] Our analysis shows that this procedure leads to somewhat clearer results and higher levels of determination than estimates with the non-adjusted start-up rate. However, the basic relationships have been left unchanged.

## 4. Direct and indirect effects of new businesses

### 4.1 The direct employment effect of new businesses

In order to analyze the direct impact of new business formation on regional employment change, we use information on the development of start-up cohorts. For the period t=0, the time when the new businesses enter the market, their direct effect is their employment share in total employment of t-1. For the following periods, the development of the number of employees in a cohort is used to express its direct impact on total employment change. While the direct effect of start-ups in the first period is positive by definition, it may be negative in subsequent periods depending on the development of employment in the respective cohort.

The direct employment effect is calculated as

$\Delta Emp_{direct\,t=n} = \frac{Emp_{cohort\,t=n} - Emp_{cohort\,t=n-1}}{Emp_{total\,t=n-1}} * 100$. Thus, start-ups of the 1984 cohort, for example, which entered the market with 230,138 employees accounted for an employment change of 1.47 percent in the initial year because $\Delta Emp_{direct\,1984} = \frac{230{,}138 - 0}{15{,}677{,}496} * 100 = 1.47$.[10] Since these businesses did not exist in the prior period, the share of employees in the cohort over all employees in t-1 gives the percentage change of employment that the 1984 start-up cohort contributed in that year. In 1985, employment in this cohort

[10] Start-ups that failed and exited before the end of year t=0 are not included in this figure.

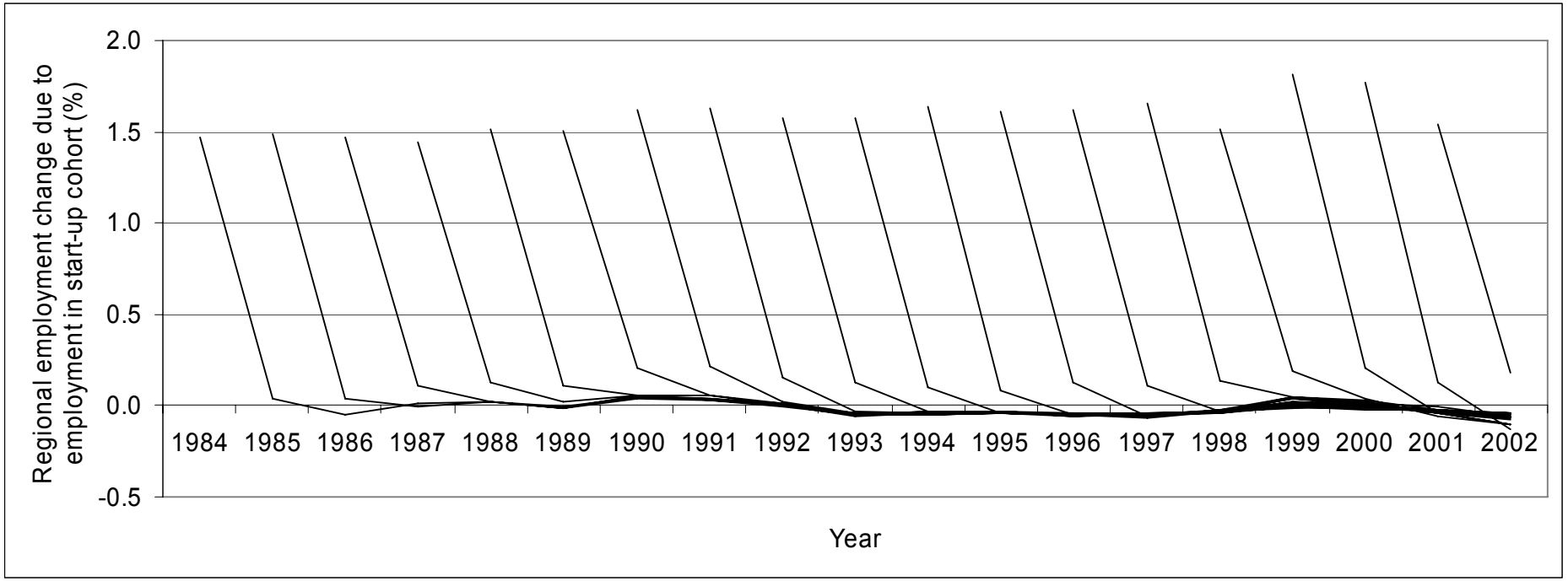



Figure 3: Employment change due to employment in entry cohorts 1984 to 2002

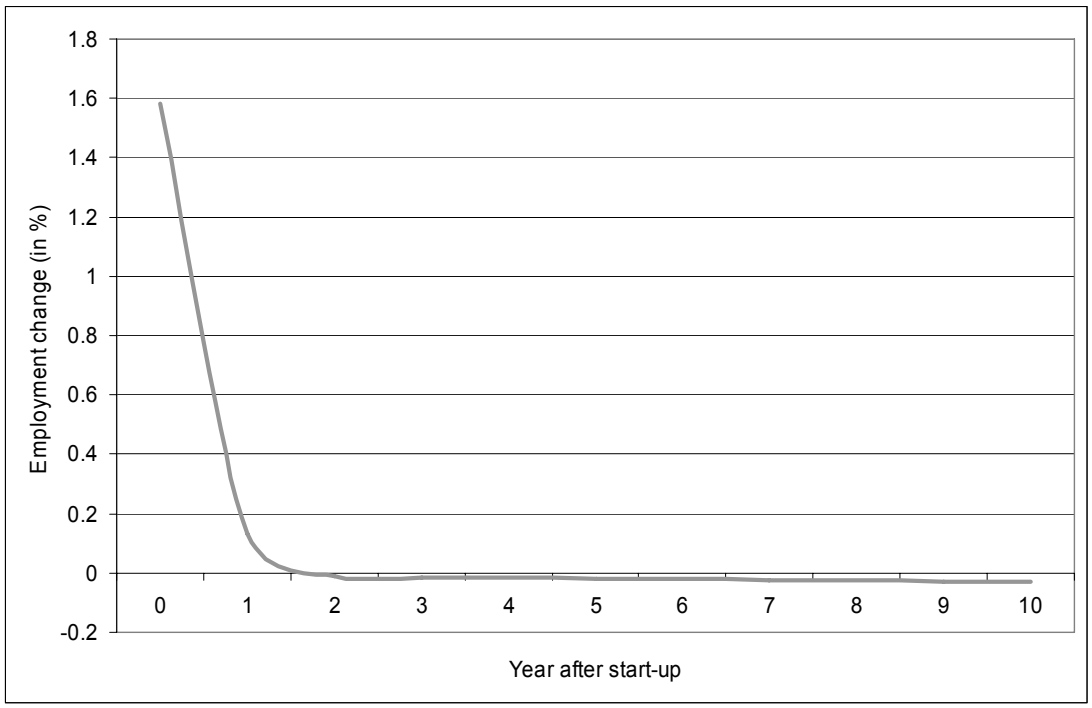



Figure 4: Average direct effect of start-ups on employment change (cohorts of 1984 to 2002)

grew from 230,138 to 236,236 employees and accounted for an employment change of 0.039 percent. Thus, we calculate the employment change of the 1984 start-up cohort in the year 1985 as

$$\Delta Emp_{direct1985} = \frac{236{,}236 - 230{,}138}{15{,}522{,}385} * 100 = 0.039 .$$ [11]

The pattern of the direct employment effect is surprisingly similar for the different start-up cohorts in our sample (figure 3). In their initial year, when the start-ups enter the market, they account for an employment increase of about 1.5 to 1.8 percent. In the first year after entry, this effect is also positive but much smaller. In later years, the start-up cohorts tend to experience an employment decline so that their direct contribution to employment change becomes slightly negative. Figure 4 displays the average direct employment effect of start-ups over a period of ten years based on the mean values of all yearly cohorts in the period of analysis. We restrict this analysis to the first

[11] Note that total employment in t-1 already includes the employees of the 1984 cohort in 1984.

ten years of the start-ups' existence because this is the length of time period for which other investigations found statistically significant effects. The figure shows very clearly that the largest direct contribution of start-ups to employment change occurs in the year they are set up. After about two years, their direct effect on employment change becomes rather small. Most remarkably, they do not directly add to overall employment but tend to cause employment decline.

## 4.2 Assessing the indirect effects of new businesses

### 4.2.1 Definitions

In order to identify the indirect employment effects of start-ups, we focus on the development of the incumbent businesses. Information about incumbent employment is generated by subtracting the employment in the start-up cohorts from overall employment. We then apply a weighting procedure in order to express employment change in incumbents as a share of overall employment change. This allows direct comparison of the magnitude of the direct effect and the indirect effects.

Table 1 provides an overview of the definition of the weighted employment change in incumbent businesses. $Emp_{inc}$ denotes the number of employees in incumbents in a certain year, $Emp_{total}$ is the total employment, and $Emp_{new}$ is the number of employees in new businesses. We determine the employment that the new businesses create directly by summing up the employment in the start-ups that occurred within the previous decade. Again, we account for the employment in new businesses over ten years because this is the time period for which empirical analysis could identify statistically significant effects of start-ups on employment (see Fritsch, 2008, for an overview). Using the information on total employment change ($\Delta EMP_{total}$) and on employment in the new businesses ($\Delta EMP_{new}$), we can calculate the employment change of the incumbents as

$$(1) \qquad \Delta EMP_{inc} = \Delta EMP_{total} - \Delta EMP_{new} .$$

Hence, the incumbent employment is the number of jobs in businesses which are at least ten years old. For calculating the rate of employment change in incumbent businesses between t=0 and t+2, the underlying employment figures for the two years are based on the same group of businesses. We, thereby, avoid the effect that employment change in incumbents is driven by businesses that have been classified as new businesses in t=0 and as incumbents in year t+2.[12] The employment change of the incumbent businesses encompasses indirect effects of the new businesses – displacement and supply-side effects – as well as other influences that are not caused by the regional start-ups. The annual change of total employment, of employment in start-ups, and of incumbent employment is then calculated as the average change over a two-year period, i.e. between the periods t+2 and t=0. A two-year average is used in order to avoid disturbances by short-term fluctuations.

Table 1: Definition of weighted employment change in incumbent businesses

Employment in incumbents:

$$EMP_{inc\ t=0} = EMP_{total\ t=0} - EMP_{new\ t=0\ to\ t-10}$$

$$EMP_{inc\ t+2} = EMP_{total\ t+2} - EMP_{new\ t+2\ to\ t-10}$$

Weighted employment change in incumbent businesses:

$$\Delta EMP_{inc} = (\ln EMP_{inc\ t+2} - \ln EMP_{inc\ t=0}) \frac{(EMP_{inc\ t=0} + EMP_{inc\ t+2})/2}{(EMP_{total\ t=0} + EMP_{total\ t+2})/2}$$

Regional two-year employment change of incumbent businesses.

Regional share of employees in incumbent businesses over all employees in period *t=0* to *t+2*.

[12] In the year t+2, incumbent employment equals the total employment in t+2 minus employment in the start-ups of the years t+2 to t-10 in year t+2. Incumbent employment in the year t=0 is total employment in t=0 minus employment in the start-ups of the years t=0 to t-10 in year t=0.

Because we want to assess the contribution of young businesses and of the incumbents to overall employment change, we weigh the percent of employment change in these groups with their respective share in total employment. Due to this procedure, the weighted percent employment change in incumbents and in new businesses adds up to total percent employment change. A simple example may illustrate the three employment change measures. Let us assume that the total employment change is 3.2 percent. If the share of employees in businesses younger than 10 years is 15 percent and the employment change in these young businesses is 10 percent, the respective employment change in businesses younger than 10 years is weighted by 0.2 resulting in 10 x 0.15 = 1.5 percent. In an analogous manner, the employment change of incumbents – in our example 2 percent – is also weighted by its share in total employment, which is 85 percent in our example. The weighted employment change of businesses older than 10 years is then 2 x 0.85 = 1.7 percent. Summing up the weighted employment change of incumbents and new businesses leads to 1.5 + 1.7 = 3.2 percent, which is the total employment change. The relation between the weighted employment change in new businesses (incumbent businesses) and total employment change shows the relative contribution of both groups to regional employment.[13]

[13] Example: In the Munich region, the total private employment change between the years 1998 and 2000 was 8.4 percent. The unweighted employment change in businesses older than ten years (incumbents) was 3.1 percent. For business younger than ten years (new businesses), employment change was 30.6 percent; a considerable part of which was due to the cohorts that entered that market between 1998 and 2000. The share of employees that worked in incumbent businesses over all employees for this period in the Munich region amounted to 80.6 percent, and 19.4 percent of the employees worked in new businesses. Weighting the employment change in incumbent businesses by their employment share, we get 3.1 x 0.806 = 2.5 percent. For new businesses, the weighting procedure results in 30.6 x 0.194 = 5.9 percent. Adding up employment change of incumbents and employment change of new businesses, we get 2.5 + 5.9 = 8.4 percent, which is the total employment change. The contribution of new businesses to regional employment change was (5.9 : 8.4) * 100 = 70.2 percent; the share of the incumbents amounted to (2.5 : 8.4) * 100 = 29.8 percent.

### 4.2.2 Estimation of the indirect effects

To identify the aggregate indirect effect of new business formation, we regress the start-up rates of the year t=0 and of each of the preceding ten years (t-1 to t-10) on employment change in incumbent businesses between t=0 and t+2. Since the start-up rates are highly correlated over time, an unrestricted regression would suffer from pronounced multicollinearity. In order to deal with this problem, we apply the Almon polynomial lag method (see Greene, 2003, for details), using a third-order polynomial for estimating the lag structure which turns out to be the best approximation.[14]

The regression includes regional dummies in order to control for time invariant heterogeneity across regions. We control for spatial autocorrelation by including spatial lags. Further control variables are the regional labor productivity, the regions' share of highly qualified workers, and population density. We expect positive effects for regional labor productivity and the share of highly educated employees on regional employment change because high productivity regions and regions that are well equipped with human capital should be relatively competitive. Population density is included as it accounts for several types of region-specific influences such as the level of local knowledge spillovers, house prices, thickness of local markets, etc. Because high density areas in West Germany showed a below average employment growth in the period under inspection, we expect a negative sign here. Details on the definition and measurement of these variables are given in table 2; Tables A1 and A2 in the Appendix report descriptive statistics and correlations between variables.[15]

[14] A third-order polynomial has also been found to provide the best approximation of the lag structure in earlier analyses for Germany and for many other countries (Fritsch and Mueller, 2004, 2008; Mueller, van Stel, and Storey, 2008; van Stel and Suddle, 2008). This is also true for our analysis reported here. For higher order polynomials, the shape of the resulting lag structure is rather close to the lag structure which results from assuming a third-order expression.

[15] The considerable correlation between regional labor productivity, high education level, and population density may be ignored here since these variables only act as controls and are not relevant for our interpretation of the results.

Table 2: Definition of variables

| *Variable* | *Definition* | *Expected sign* |
|---|---|---|
| Start-up rate | Number of start-ups in a region per 1,000 persons in the regional workforce[a] | + |
| Labor productivity | Gross Value Added[b] per employee[a] in a region (ln) | + |
| High education level | Share of employees in a region with a university degree (ln)[a] | + |
| Population density | Number of inhabitants in a region per square kilometer (ln)[b] | - |

a) Source: Social Insurance Statistics; b) Source: Federal Statistical Office.

Table 3 displays the regression results for the impact of regional start-up rates on weighted employment change in incumbent businesses. The resulting lag structure based on the Almon procedure (figure 5) indicates that the aggregate indirect effect of new business formation is positive in the initial year t=0 when the newcomers are set up, which may be caused by their demand for resources. The significantly positive coefficient for the aggregate indirect effect in this year clearly indicates that such demand effects are considerably stronger than the displacement effects in this initial period. In the following years the indirect effect then soon turns negative and becomes positive once again between the fifth and the sixth year after start-up. After reaching a maximum in the eighth year after start-up, the aggregate indirect effect becomes weaker in the ninth year and is about zero in the tenth year. The three control variables are all statistically significant with the expected signs.

Table 3: Impact of start-up activity on regional employment change in incumbent businesses (third-order polynomial)[a]

| | Employment change of incumbents (in %), 2 years | | | |
|---|---|---|---|---|
| | unrestricted regression | regression with Almon polynomial lags | | |
| Start-up rate (t=0) | 0.217** | α1 | 0.135** | 0.135 |
| | (0.048) | | (0.039) | |
| Start-up rate (t-1) | -0.168** | α2 | -0.197** | -0.016 |
| | (0.053) | | (0.046) | |
| Start-up rate (t-2) | 0.0594 | α3 | 0.0487** | -0.088 |
| | (0.063) | | (0.011) | |
| Start-up rate (t-3) | -0.0105 | α4 | -0.00303** | -0.099 |
| | (0.068) | | (0.00069) | |
| Start-up rate (t-4) | -0.0545 | | | -0.068 |
| | (0.069) | | | |
| Start-up rate (t-5) | -0.0675 | | | -0.011 |
| | (0.064) | | | |
| Start-up rate (t-6) | 0.0965 | | | 0.052 |
| | (0.063) | | | |
| Start-up rate (t-7) | 0.175** | | | 0.103 |
| | (0.066) | | | |
| Start-up rate (t-8) | 0.0626+ | | | 0.125 |
| | (0.052) | | | |
| Start-up rate (t-9) | 0.0924 | | | 0.099 |
| | (0.056) | | | |
| Start-up rate (t-10) | 0.0320+ | | | 0.006 |
| | (0.051) | | | |
| Labor productivity, t-1 (ln) | 13.44** | | | 13.35** |
| | (3.42) | | | (3.54) |
| Share of highly qualified workers, t-1 (ln) | 10.94** | | | 11.27** |
| | (1.75) | | | (1.81) |
| Population density, t-1 (ln) | -32.53** | | | -37.79** |
| | (9.01) | | | (8.97) |
| Constant | 33.78 | | | 62.78 |
| | (68.4) | | | (70.5) |
| rho – spatial correlation | 0.0344** | | | 0.0321*** |
| | (0.011) | | | (0.011) |
| Region dummies | Yes** | | | Yes** |
| Wald-test | 9.51** | | | 8.07** |
| Likelihood ratio-test | 7.20** | | | 6.13** |
| Variance Ratio | 0.61 | | | 0.60 |

a The total number of observations is 568. Estimates are based on ML spatial lag regression. Robust standard errors in parentheses; + Statistically significant at the 10 percent level; ** Statistically significant at the 5 percent level; *** Statistically significant at the 1 percent level

### 4.3 Comparison of the direct and the indirect employment effects of new business formation

Adding up the direct effect as derived from start-up cohorts (section 4.1) and the estimated indirect effects (section 4.2.2) of new business formation on regional employment gives the overall effect for an average region. In order to compare the aggregate indirect effects with the direct effect, we calculate the aggregate indirect effect for the mean start-up rate which is a little more than 9 start-ups per 1,000 persons in the workforce). The resulting curve for the overall effect (figure 5) corresponds well to the respective results that have been found in earlier studies for Germany (Fritsch and Mueller, 2004, 2008). The picture shows very clearly that the largest part of the overall effect is caused by indirect effects on the incumbents. The main deviation between the two curves is that the aggregate indirect effect is much lower than the overall effect in the first two years, which is due to the direct effect of new business formation on regional employment in this early period.

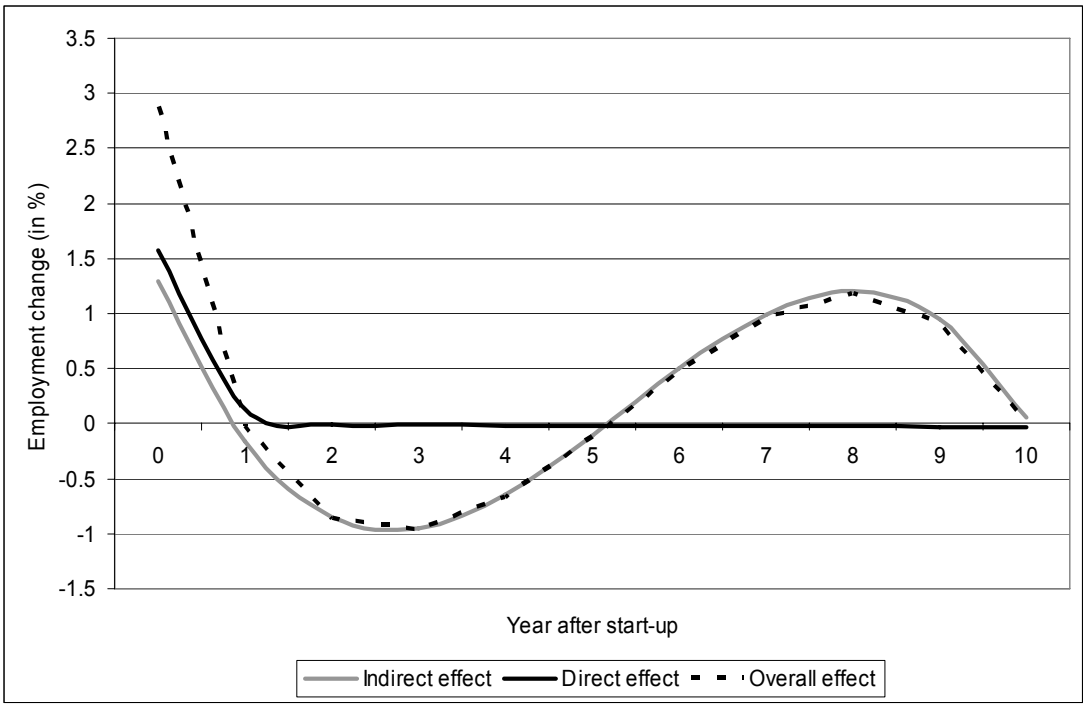



Figure 5: Impact of start-ups on regional employment change – direct and indirect effects

Adding up the overall effect of start-ups on regional employment over the period of analysis results in an increase of about 3.8 percent (table 4). This means that in the average West German region, start-ups have led to an employment growth of nearly 4 percent over a time period of eleven years.[16] While the employment in the new businesses equals about 40 percent of this contribution to employment growth, the other 60 percent are due to the indirect effects. This means that almost two-thirds of the employment change caused by new business formation emerges from the interaction of the newcomers with the incumbents in the respective region. The employment in the start-ups clearly causes only the smaller part of the overall effect.

Table 4: Composition of the effect of new business formation on regional employment change: Direct and indirect effects (percent)

| Period | Direct effect | Aggregate indirect effect | Overall effect |
|---|---|---|---|
| T=0 | 1.58 | 1.30 | 2.88 |
| T+1 | 0.13 | -0.15 | -0.02 |
| T+2 | -0.01 | -0.85 | -0.86 |
| T+3 | -0.01 | -0.95 | -0.97 |
| T+4 | -0.02 | -0.65 | -0.67 |
| T+5 | -0.02 | -0.11 | -0.13 |
| T+6 | -0.02 | 0.50 | 0.48 |
| T+7 | -0.02 | 0.99 | 0.97 |
| T+8 | -0.03 | 1.20 | 1.17 |
| T+9 | -0.03 | 0.95 | 0.92 |
| T+10 | -0.03 | 0.06 | 0.03 |
| ∑ | 1.52 | 2.27 | 3.79 |

The results attained so far can be summarized as follows:

[16] This result corresponds quite well to the estimates of Fritsch and Mueller (2008). According to Fritsch and Mueller (2008), one additional start-up per 1,000 employees leads to an overall employment increase of about 0.46 percent in the average region. Given an average start-up rate of about 9 new businesses per 1,000 employees, this results in 4.14 percent additional employment due to new business formation.

I. The direct effect of new business formation on employment change in t=0 and t+1 is strongly positive. For all latter periods, the impact is slightly negative.

II. The aggregate indirect effect is positive in the initial period (t=0) when the new businesses enter the market. Hence, in this period the negative displacement effect is clearly smaller than the employment-generating demand of the newcomers for resources.

III. On average, the aggregate indirect effect is quantitatively 1.5 times larger than the direct effect.

We now investigate regional differences or these results for three types of regions: the agglomerations, the moderately congested areas, and the rural regions.

## 5. Differences between agglomerations, moderately congested areas, and rural regions

We apply the decomposition procedure reported above in order to explain the regional differences of the employment effects of new businesses that have been found for agglomerations, for moderately congested areas, and rural regions. We find that the direct employment effects are rather similar in these three types of regions (figure 6). In the year of start-up, the direct employment effect is slightly larger in rural areas than in the moderately congested areas and in agglomerations. But these deviations are rather small and are in no way suited to explain the observed regional differences.

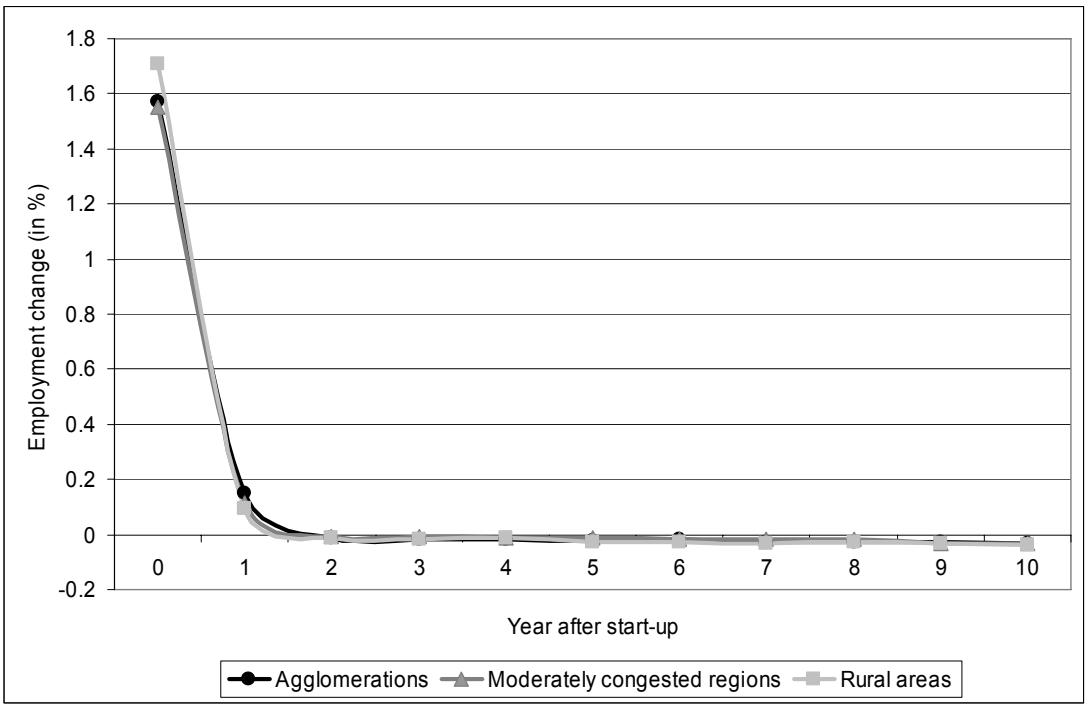



Figure 6: Average direct effect of start-ups on employment change in different types of regions

For assessing the aggregate indirect effect of new business formation on employment in the three types of regions, we estimated basically the same regression model as above (table 3) but included dummies for the type of regions that were interacted with the start-up rate (table A3 in Appendix). The resulting curves for the indirect effects of new business formation based on the Almon-Lag procedure using a third-order polynomial are depicted in figure 7. The aggregated indirect effects are calculated for the mean start-up rate in the different types of regions which is on average highest in rural areas (around 10) and lowest in moderately congested regions (around 9). One basic result from this analysis is that the indirect effects differ considerably between the regions. Given the rather similar direct effects, we can, therefore, conclude that the regional differences between the three types of regions are caused by the indirect effects. This again indicates that it is the interaction of the start-ups with their regional environment that causes the difference in the overall effect!

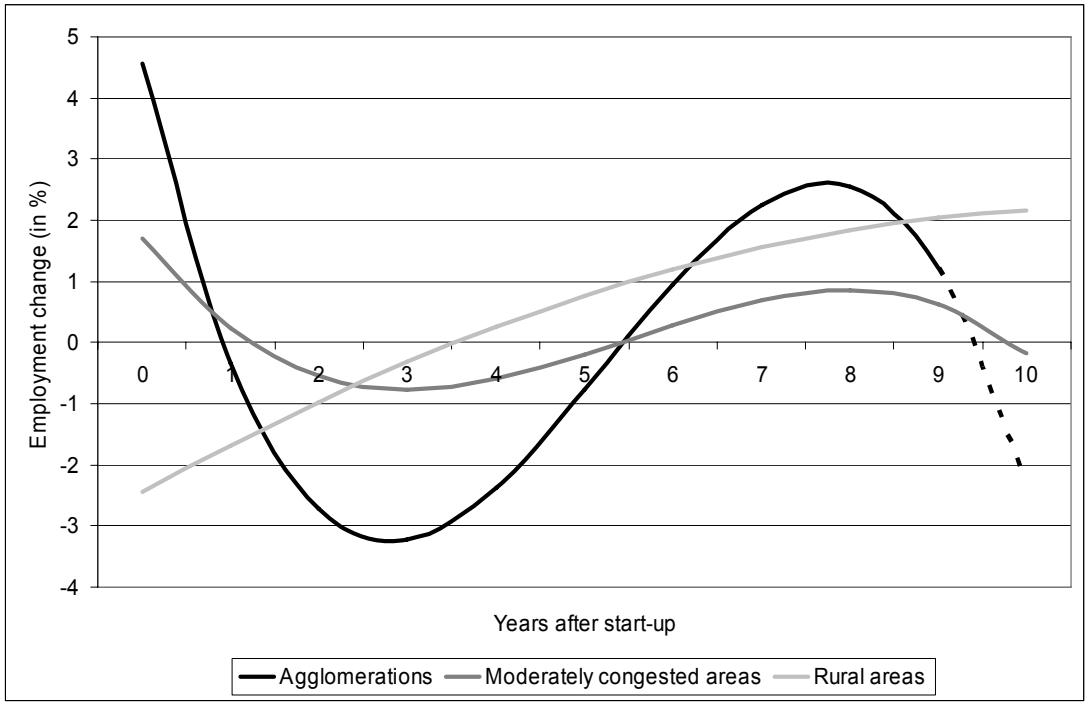



Figure 7: Average indirect effects of start-ups on employment change in different types of regions

The basic shape of the curves for the aggregate indirect effect in agglomerations and in moderately congested regions basically looks similar. The difference between these two curves is that the amplitude of the wave is more pronounced in the agglomerations, indicating a higher intensity of the indirect effects. This higher intensity of the indirect effects in the agglomerations suggests a higher level of interaction in these regions, which may directly result from higher density, particularly from spatial proximity to relatively many other actors. The more pronounced the negative indirect effect in the agglomerations between year one and year six after start-up are, suggests higher displacement effects that may result from a higher intensity of competition in these regions. This relatively intensive competition and selection in agglomerations may then explain the more pronounced supply-side effects that dominate the third phase of the wave. Another main difference between the agglomerations and moderately congested areas, on the one hand, and the rural regions, on the other hand, concerns the directions of the aggregate indirect effects in the first years. In the

agglomerations and the moderately congested areas, the early indirect effect is positive suggesting that demand-side effects of the resources purchased by the newly founded businesses in their region are much stronger than the displacement effects. In the rural regions, the early indirect effects are significantly negative. This suggests that the demand for resources of the start-ups in rural regions becomes largely effective in other areas, which may be explained by the poor domestic supply. It is also remarkable that the values for the coefficients of the aggregate indirect effect in rural areas do not decrease in the last periods as is the case in the estimates for the agglomerations and the moderately congested areas. This does, however, not mean that the magnitude of the aggregate indirect effect of new business formation increases further in later periods because the unrestricted regressions coefficients for the start-up rate in later periods never prove to be statistically significant if included into the model.

All in all, these results indicate that the agglomerations have important advantages over the moderately congested areas and, particularly, as compared to the rural regions with respect to the effects of new business formation. These advantages are mainly due to the indirect effects of new business formation. We suppose that the more pronounced indirect effects arise from the spatial proximity to many actors and a relatively high intensity of competition for resources as well as on markets for output.

## 6. Conclusion

The aim of this study was to shed more light on the relative importance of the direct and the indirect effects of new business formation on regional employment and to investigate regional differences that have been found between certain types of regions. One main result is that the indirect effects of new business formation are larger than the direct effects. Accordingly, the largest part of the differences in the overall effects that are found between different types of regions can be explained by the respective indirect effects. We conclude that the interaction between the start-ups and their economic environment is a main source of employment and growth. Our results clearly

suggest that the agglomerations have a strong advantage over the less densely populated regions in this respect. This relationship between regional density and the effect of new business formation deserves to be further investigated. In contrast to these regional differences of the indirect effects, we found that the direct contribution of start-ups to regional employment is rather similar across the different types of regions.

The finding that the indirect effects of new business formation are quantitatively larger than the direct effect does *not* mean that the new businesses are of minor importance. The indirect effects would not occur without the start-ups challenging the incumbents. Our results suggest that it is the interaction between the start-ups and the incumbents that is important for the effect of new businesses on economic development. Hence, the strength of the newcomers relative to the incumbents could maybe help to explain regional differences in the indirect effects. Moreover, one may well speculate that not all start-ups have a similar impact on employment but that there are regional differences in this respect. It would be quite plausible if innovative new businesses, which are a relatively great challenge for the incumbents, produce a larger indirect effect than purely imitative entries, which play only a marginal role in the respective industry. Further research is needed to find out more about the factors that determine the effect of new business formation on employment.

## Appendix

Table A1: Descriptive statistics

| Variable | Mean | Median | Minimum | Maximum | Standard Deviation |
|---|---|---|---|---|---|
| Weighted employment change of incumbents (in %, two years) | -2.84 | -2.87 | -9.46 | 6.00 | 2.45 |
| Ln regional labor productivity, t-1 | 11.30 | 11.29 | 11.07 | 11.61 | 0.09 |
| Ln regional share of highly qualified workers, t-1 | -3.20 | -3.22 | -4.27 | -1.93 | 0.45 |
| Ln regional population density | 5.44 | 5.32 | 4.32 | 7.13 | 0.66 |
| Start-up rate t=0 | 9.95 | 9.23 | 5.73 | 38.95 | 3.34 |
| Start-up rate t-1 | 9.67 | 8.98 | 5.73 | 38.95 | 3.23 |
| Start-up rate t-2 | 9.26 | 8.77 | 5.73 | 32.59 | 2.92 |
| Start-up rate t-3 | 9.18 | 8.70 | 5.54 | 28.96 | 2.86 |
| Start-up rate t-4 | 9.17 | 8.68 | 5.54 | 28.96 | 2.91 |
| Start-up rate t-5 | 9.19 | 8.68 | 5.54 | 29.75 | 2.99 |
| Start-up rate t-6 | 9.20 | 8.67 | 5.54 | 29.75 | 3.02 |
| Start-up rate t-7 | 9.22 | 8.67 | 5.54 | 30.02 | 3.09 |
| Start-up rate t-8 | 9.31 | 8.69 | 5.54 | 30.02 | 3.21 |
| Start-up rate t-9 | 9.34 | 8.70 | 5.54 | 30.02 | 3.25 |
| Start-up rate t-10 | 9.31 | 8.65 | 5.54 | 30.02 | 3.27 |

Table A2: Correlations between variables

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Weighted employment change of incumbents (in %, two years) | 1 | | | | | | | | | | | | | |
| 2 | Ln regional labor productivity, t-1 | 0.24 | 1 | | | | | | | | | | | | |
| 3 | Ln regional share of highly qualified workers, t-1 | 0.19 | 0.52 | 1 | | | | | | | | | | | |
| 4 | Ln regional population density | -0.06 | 0.27 | 0.66 | 1 | | | | | | | | | | |
| 5 | Start-up rate t=0 | 0.18 | 0.24 | 0.02 | -0.09 | 1 | | | | | | | | | |
| 6 | Start-up rate t-1 | 0.08 | 0.22 | 0.01 | -0.09 | 0.85 | 1 | | | | | | | | |
| 7 | Start-up rate t-2 | 0.03 | 0.17 | -0.04 | -0.09 | 0.83 | 0.85 | 1 | | | | | | | |
| 8 | Start-up rate t-3 | 0.00 | 0.14 | -0.05 | -0.08 | 0.80 | 0.82 | 0.87 | 1 | | | | | | |
| 9 | Start-up rate t-4 | -0.01 | 0.15 | -0.07 | -0.10 | 0.78 | 0.80 | 0.87 | 0.86 | 1 | | | | | |
| 10 | Start-up rate t-5 | -0.01 | 0.14 | -0.08 | -0.10 | 0.78 | 0.79 | 0.86 | 0.88 | 0.87 | 1 | | | | |
| 11 | Start-up rate t-6 | 0.02 | 0.16 | -0.09 | -0.10 | 0.78 | 0.79 | 0.85 | 0.86 | 0.88 | 0.87 | 1 | | | |
| 12 | Start-up rate t-7 | 0.03 | 0.15 | -0.09 | -0.09 | 0.77 | 0.79 | 0.85 | 0.86 | 0.85 | 0.88 | 0.87 | 1 | | |
| 13 | Start-up rate t-8 | 0.03 | 0.14 | -0.10 | -0.11 | 0.77 | 0.77 | 0.84 | 0.84 | 0.83 | 0.84 | 0.86 | 0.85 | 1 | |
| 14 | Start-up rate t-9 | 0.03 | 0.12 | -0.10 | -0.10 | 0.76 | 0.78 | 0.83 | 0.85 | 0.83 | 0.84 | 0.84 | 0.86 | 0.82 | 1 |
| 15 | Start-up rate t-10 | 0.01 | 0.13 | -0.09 | -0.10 | 0.75 | 0.77 | 0.82 | 0.83 | 0.83 | 0.83 | 0.84 | 0.84 | 0.83 | 0.83 |

Table A3: Impact of start-up activity on regional employment change in incumbent businesses in different types of regions

| | Employment change of incumbents (in %), 2 years | | | |
|---|---|---|---|---|
| | (I) unrestricted regression | | (II) regression with Almon polynomial lags | |
| Start-up rate (t=0), rural areas | -0.0983 (0.081) | α1 | -0.245** (0.071) | -0.245 |
| Start-up rate (t-1), rural areas | -0.381** (0.11) | α2 | 0.0795 (0.078) | -0.168 |
| Start-up rate (t-2), rural areas | 0.0343 (0.11) | α3 | -0.00275 (0.019) | -0.097 |
| Start-up rate (t-3), rural areas | 0.0404 (0.12) | α4 | -0.0000591 (0.0013) | -0.032 |
| Start-up rate (t-4), rural areas | 0.129 (0.12) | | | 0.026 |
| Start-up rate (t-5), rural areas | 0.0845 (0.15) | | | 0.077 |
| Start-up rate (t-6), rural areas | 0.132 (0.15) | | | 0.121 |
| Start-up rate (t-7), rural areas | 0.280* (0.13) | | | 0.157 |
| Start-up rate (t-8), rural areas | -0.0462 (0.14) | | | 0.185 |
| Start-up rate (t-9), rural areas | 0.195 (0.12) | | | 0.205 |
| Start-up rate (t-10), rural areas | 0.280* (0.12) | | | 0.216 |
| Start-up rate (t=0), moderately congested areas | 0.234** (0.054) | α1 | 0.186** (0.049) | 0.186 |
| Start-up rate (t-1), moderately congested areas | -0.0922 (0.060) | α2 | -0.205** (0.054) | 0.025 |
| Start-up rate (t-2), moderately congested areas | 0.0773 (0.076) | α3 | 0.0470** (0.013) | -0.059 |
| Start-up rate (t-3), moderately congested areas | 0.0434 (0.076) | α4 | -0.00285** (0.00079) | -0.083 |
| Start-up rate (t-4), moderately congested areas | -0.0559 (0.086) | | | -0.065 |
| Start-up rate (t-5), moderately congested areas | -0.0889 (0.071) | | | -0.021 |
| Start-up rate (t-6), moderately congested areas | 0.00104 (0.061) | | | 0.031 |
| Start-up rate (t-7), moderately congested areas | 0.117 (0.080) | | | 0.075 |
| Start-up rate (t-8), moderately congested areas | 0.0969 (0.066) | | | 0.092 |
| Start-up rate (t-9), moderately congested areas | 0.0876+ (0.046) | | | 0.067 |

Table A3 continued:

| | | | | |
|---|---|---|---|---|
| Start-up rate (t-10), moderately congested areas | -0.0374<br>(0.065) | | | -0.018 |
| Start-up rate (t=0), agglomerations | 0.514**<br>(0.11) | α1 | 0.458**<br>(0.074) | 0.458 |
| Start-up rate (t-1), agglomerations | -0.0903<br>(0.11) | α2 | -0.636**<br>(0.11) | -0.034 |
| Start-up rate (t-2), agglomerations | -0.151<br>(0.16) | α3 | 0.155**<br>(0.027) | -0.274 |
| Start-up rate (t-3), agglomerations | -0.410*<br>(0.17) | α4 | -0.00981**<br>(0.0019) | -0.322 |
| Start-up rate (t-4), agglomerations | -0.343*<br>(0.17) | | | -0.238 |
| Start-up rate (t-5), agglomerations | -0.0122<br>(0.15) | | | -0.078 |
| Start-up rate (t-6), agglomerations | 0.378**<br>(0.12) | | | 0.096 |
| Start-up rate (t-7), agglomerations | 0.284*<br>(0.13) | | | 0.227 |
| Start-up rate (t-8), agglomerations | 0.0315<br>(0.12) | | | 0.256 |
| Start-up rate (t-9), agglomerations | -0.170<br>(0.14) | | | 0.124 |
| Start-up rate (t-10), agglomerations | -0.107<br>(0.13) | | | -0.229 |
| Labor productivity, t-1 (ln) | 16.52**<br>(3.07) | | | 15.89**<br>(3.12) |
| Share of highly qualified workers, t-1 (ln) | 8.914**<br>(1.57) | | | 9.579**<br>(1.64) |
| Population density, t-1 (ln) | -20.54*<br>(8.21) | | | -26.53**<br>(8.24) |
| Constant | -67.86<br>(61.9) | | | -28.00<br>(58.3) |
| rho – spatial correlation | 0.0331**<br>(0.010) | | | 0.0289**<br>(0.011) |
| Regional dummies | Yes** | | | Yes** |
| Wald-test | 10.08** | | | 7.35** |
| Likilihood Ratio-test | 7.69** | | | 5.70* |
| Variance Ratio | 0.67 | | | 0.64 |

The total number of observations is 568. Estimates are based on a ML spatial lag regression. Robust standard errors 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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