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Start-ups, Long- and Short-Term Survivors and their Effect on Regional Employment Growth

by

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Abstract

We investigate the effects that regional start-up activity has on employment in new and in incumbent businesses. The analysis is performed for West German regions over the 1987-2002 period. It shows that the effects of new businesses on employment in the incumbents are significantly positive and that this indirect effect on incumbent employment leads to more jobs than what is created by the newcomers. We find that the effect of new business formation on incumbents is exclusively driven by start-ups that survive a certain period of time. We draw conclusions for policy and for further research.

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1. Aims and scope[1]

New businesses can contribute to employment growth in a number of ways. Most empirical analyses of the employment effects of start-ups have focused on the jobs that are generated in the new entities, which may be labeled their *direct effect*.[2] However, new business formation may also have several types of *indirect effects* on the incumbent businesses. One type of such an indirect effect is the displacement of incumbent suppliers by the newcomers. A second type of indirect effect is the improvement on the supply-side of the economy due to the additional competition exerted by the entries. These supply-side improvements raise productivity of the economy and may induce higher competitiveness and more employment (Aghion et al., 2004, 2009; Disney, Haskell, and Heden, 2003).[3]

While a number of studies have analyzed the direct employment effects of new business formation, i.e. their development over time, the indirect effects have remained largely unexplored. This paper tries to fill this gap by investigating these indirect effects. In particular, we test three hypotheses. The first of these hypotheses is that the overall indirect employment effect of new business formation that results from the displacement of incumbents *and* from improvements on the supply-side is positive. This implies that the supply-side effects are considerably larger than the displacement effects. The second hypothesis states that the indirect effects of new business formation lead to more employment than what is created by the newcomers. Third, we investigate if successful start-ups which are able to survive in the market for a certain period of time have a larger effect on employment than those new businesses which have to exit relatively

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[2] This type of research has been initiated by a study for the US by David Birch (1981), who claimed that new firms generate more jobs than incumbents.

[3] A third type of indirect effect results from the demand of the new entities for resources; see Fritsch and Noseleit (2009) for details.

soon. Assuming that those new businesses which are able to survive constitute a particular challenge for the incumbents, their indirect effects – especially the induced supply-side improvements – should be considerably larger than for those entries which fail (Falck, 2007).

A relatively high importance of indirect effects of entry on employment has considerable implications for policy as well as for further empirical investigations. If most of the employment that is induced by new businesses occurs in the incumbents, empirical analyses should not solely focus on the jobs created by the newcomers as is the case in nearly all previous studies on the issue. Moreover, since the occurrence of positive supply-side effects requires a well-working market mechanism, policy should avoid any distortion of the market selection process, e.g. by subsidizing newcomers.

Our empirical analysis is based on data for West-German regions for the 1975-2002 period. We investigate the employment effects of new business formation at a regional level because an analysis at the level of industries leads to serious difficulties in the interpretation of the results. These difficulties result from the observation that industries may follow a life cycle (Klepper, 1996). If this is the case, 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. 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. And, indeed, entirely different results are found if, for example, 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 for such an analysis than industries.

The following section (section 2) reviews recent research on the influence of new business formation on employment and explains the

direct and the indirect effects in more detail. In section 3 we discuss the measures for employment effects in new businesses and in the incumbents. A description of the data and of the spatial framework of the analysis follows in section 4. Section 5 provides an overview on the relative importance of employment change in new businesses and in incumbents followed by the in-depth empirical analysis of the different effects (section 6). The final section (section 7) draws conclusions for empirical analyses as well as for public policy.

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

New businesses represent an entry of new capacities into the market. By challenging the incumbent firms, the newcomers are subject to the process of market selection. Due to competition and market selection, only a fraction of the start-ups survive for a longer period of time (Boeri and Cramer, 1992; Wagner 1994; Fritsch and Weyh, 2006), and those which do succeed in establishing 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 are forced to exit. At a constant output level, this market selection process should lead to a decline in employment, not to an increase, because with higher productivity fewer resources are needed for producing a given amount of goods and services. Hence, although starting a new business means creating extra capacities that require additional personnel to operate them, the effect of new business formation on the number of jobs in the economy does not necessarily need to be positive, but could just as well be negative.

However, a well-functioning market process is in no way a zero-sum game in which the gains of one actor are necessarily completely at the expense of the other actors. There are several ways in which competition by entry of new businesses can stimulate employment

growth on the supply-side of the market. The main supply-side effects of entry could be (see Fritsch, 2008, for a more detailed review):

- *Securing efficiency and stimulating productivity increase* by contesting established market positions;

- *Acceleration of structural change*;

- *Amplified innovation*, particularly the creation of new markets;

- *Greater variety* of products and problem solutions[4].

The displacement effects as well as the supply-side effects are rather indirect in character. Displacement effects may occur on the output markets as well as on the input markets and are, therefore, not necessarily limited to the industry to which the start-ups belong. Also the supply-side effects can occur in completely different industries if the improved products are used as input there. It is important to note that a considerable part of the indirect effects may occur in establishments that are located in other regions or countries. Therefore, the size of the indirect effects is probably underestimated when focusing solely on the development in the region or country where the start-ups occurred. With a market selection process that works according to a survival of the fittest scenario, the direct employment effect and the displacements, taken together, will probably lead to decline in employment. Therefore, it is the *indirect supply-side effects* which can be supposed to be the drivers of competitiveness in the respective region that may lead to employment growth. They are the main reason why the formation of new businesses should induce more employment.

It is important to note that the emergence of positive supply-side effects of new business formation does not necessarily require the

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[4] Such an increased variety implies a higher probability of finding a supply with a better match for customer preferences. Increased variety due to new supplies may stimulate an intensified division of labor as well as follow-up innovation and can, therefore, generate significant impulses for economic development. For the relationship between variety and economic development, see Saviotti and Pyka (2004).

newcomers to be successful and to survive. As long as entry induces improvements on the side of the incumbents, it will generate positive supply-side effects, even if most of the new businesses fail and have to exit the market shortly after entry. In this view, even the failed start-ups can make a significant contribution to the improvement of supply and competitiveness. However, if survival and success are an indication for the intensity of the challenge that the newcomers exert on the incumbents, it may play a role that they stay in the market at least for a certain period of time. In an empirical analysis on the level of industries, Falck (2007) found that new businesses that survived for at least five years ('long-distance runners') had a significantly positive impact on GDP growth while the effect of entries that stayed in the market for only one year ('mayflies') was statistically insignificant or significantly negative. These results suggest that not all entries are of equal importance for economic development but that the quality of the newcomers plays a decisive role.

3. Definition of employment effects

Following Fritsch, Noseleit, and Schindele (2010), we split the overall employment change of full time employees in the private sector (ΔEMP_{total}) into two components: the employment change in the newly founded businesses (ΔEMP_{new}) and the employment change in the incumbents (ΔEMP_{inc}), i.e.

(1) $\qquad \Delta EMP^{\ total} = \Delta EMP^{\ inc} + \Delta EMP^{\ new}$

Using the information on total employment change (ΔEMP_{total}) and on employment in the new businesses (ΔEMP_{new}), we can calculate the employment change of the incumbents as

(2) $\qquad \Delta EMP^{\ inc} = \Delta EMP^{\ total} - \Delta EMP^{\ new}$.

This employment change of the incumbent businesses encompasses the 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.

Since earlier studies (see Fritsch, 2008, for an overview) suggest that the effect of new businesses on employment evolves over a period of ten years, 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[5]. Hence, the employment in the start-ups is defined as the number of employees in the start-up cohorts of the previous ten years. For assessing the employment in the incumbents in a certain year, we subtract the current employment in the start-ups from the previous ten years, from total employment. Therefore, the incumbent employment is the number of jobs in businesses that are at least ten years old. The annual change of total employment, of employment in start-ups, and of incumbent employment is then calculated as the respective employment growth between *t-1* and *t=0*.For calculating the rate of employment change in incumbent businesses, the underlying employment figures for the two years are in each case 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-1* and as incumbents in year *t=0*. The figure for employment change in new businesses is, however, affected by changes in the population of observations because in *t-1* the current and the recent ten (*t-1* to *t-11*) cohorts are included while the information on new business employment in t=0 is based on twelve (*t=0* to *t-11*) cohorts (table 1). Because we want to assess the contribution of young businesses and of the incumbents to overall employment change, we weight the percent employment change in these groups with their respective share of total employment. Due to this weighting procedure, the resulting percent employment change in new and incumbent businesses adds up to the

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[5] Acs and Mueller (2008), Arauzo-Carod, Liviano-Solis, and Martin-Bofarull (2008), Baptista, Escária, and Madruga (2008), Carree and Thurik (2008), Fritsch and Mueller (2008), Mueller, van Stel, and Storey (2008), van Stel and Suddle (2008).

total percent employment change. Since the data set contains information about start-up cohorts beginning with the year 1976 and because we analyze the effects of the ten previous yearly cohorts, our employment growth measures relate to employment growth in the period between 1987 and 2002.

Table 1: Definition of direct and indirect employment effects of new businesses

Variable	Definition
Overall employment change	$EMP^{total} = ((EMP^{total}_{t=0} / EMP^{total}_{t-1}) - 1)$
Employment in new businesses	$EMP^{new}_{t=0}$ = Employment in start-up cohorts from the years t-11 to t=0 in year t=0 EMP^{new}_{t-1} = Employment in start-up cohorts from the years t-11 to t-1 in year t-1
Weighted employment change in new businesses	$\Delta EMP^{new} = ((EMP^{new}_{t=0} / EMP^{new}_{t-1}) - 1) \dfrac{(EMP^{new}_{t-1})}{EMP^{total}_{t-1}}$
Employment in incumbents	$EMP^{inc}_{t=0} = EMP^{total}_{t=0} - EMP^{new}_{t=0}$ $EMP^{inc}_{t-1} = EMP^{total}_{t-1} - EMP^{new}_{t-1}$
Weighted employment change in incumbent businesses	$\Delta EMP^{inc} = ((EMP^{inc}_{t=0} / EMP^{inc}_{t-1}) - 1) \dfrac{(EMP^{inc}_{t-1})}{EMP^{total}_{t-1}}$

In the period for which we analyze employment change (1987-2002), the major share, on average around 77 percent of total employment, was in incumbent businesses while 23 percent of employees worked in businesses which have been set up in the previous ten years. This implies that overall employment change is mainly influenced by employment change in the incumbent businesses. Table 1 displays the definitions of the different variables for the employment effects of new businesses. Note that, according to these definitions, the employment change in new businesses may well be negative. It should also be noted that the employment in the start-up

cohorts of the previous ten years also reflects indirect effects of new business formation since it is affected by competitors that have entered the market during this time span. Such indirect effects have, however, to be disregarded in our approach.

4. Data and spatial framework of analysis

Our data are derived from the Establishment History Panel of the German Social Insurance Statistics for the years 1975 to 2002. This data set contains comprehensive information about the German economy. Not included are establishments without employees subject to obligatory social insurance payments (Spengler, 2008). The data allow us to follow employment in cohorts of newly founded businesses over time. 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 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 available for a quite long time period (1975-2002), the time series for East Germany is much shorter beginning in the year 1993. Second, many studies have shown 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., Kronthaler, 2005). The Berlin region had to be excluded due to changes in the definition of that region after the unification of Germany in 1990.

We find rather close correspondence between the employment change in incumbents and overall employment change over time, indicating that overall development of employment was largely shaped by the incumbents (figure 1). In contrast to these cyclical patterns, employment change in the new businesses is rather stable over time. This suggests that the overall development of employment is mainly due to changes in the incumbent businesses.
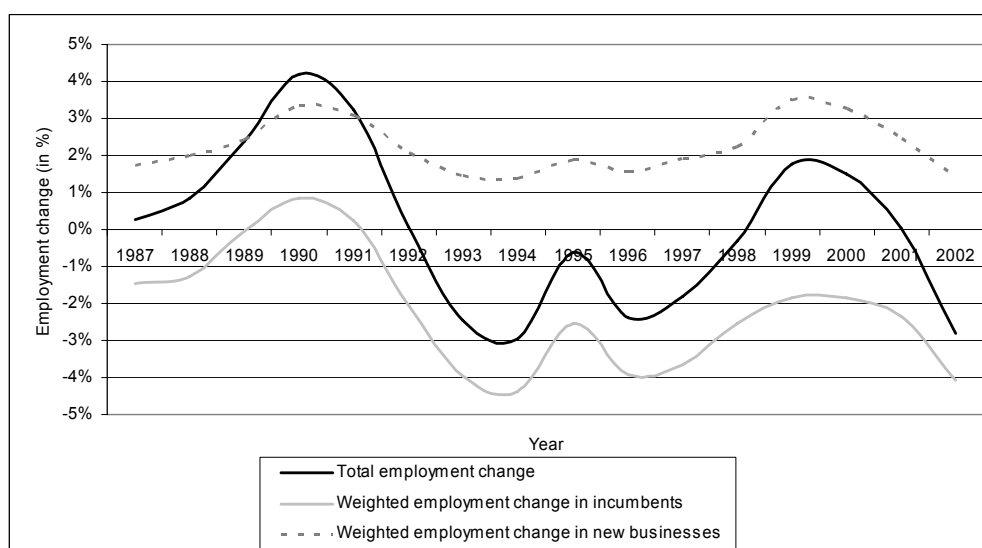

Figure 1: Average employment change (in percent) in West German regions over time

As could have been expected from the relatively strong impact of incumbent employment on overall employment, we find that the regional distribution of employment change in incumbent businesses (figure 4) is quite similar to the regional distribution of total employment development (figure 3). The correlation coefficient between total employment change and weighted employment change in incumbent businesses is 0.87. Compared to this close statistical relationship, the correlation between weighted employment change in new businesses and overall employment change is relatively low (0.54). The correlation coefficient between the weighted employment change in new
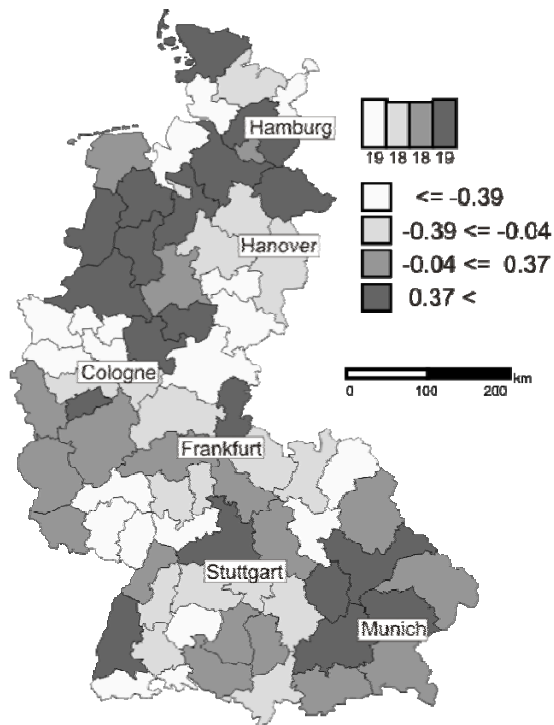
Figure 3: Spatial distribution of total employment change
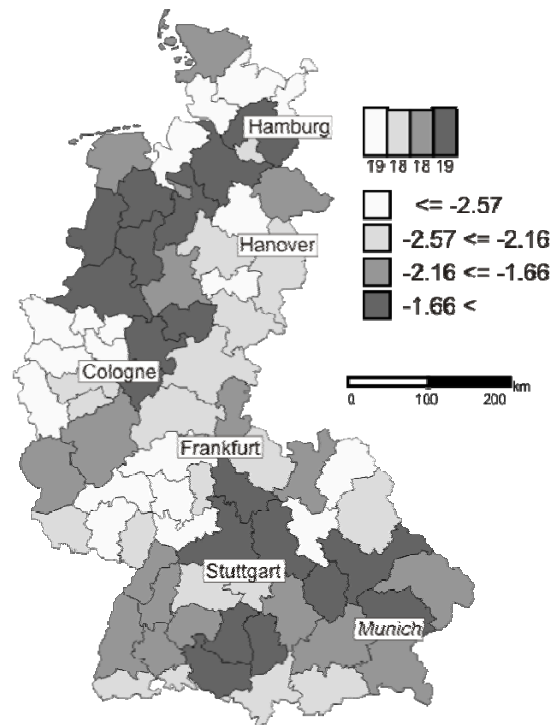(mean percentage values 1987 – 2002)

Figure 4: Spatial distribution of employment change of incumbent businesses (mean percentage values 1987 – 2002)
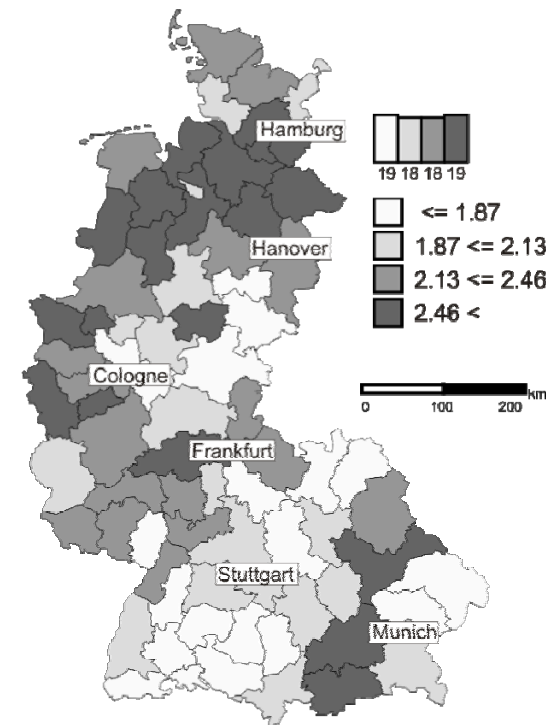
Figure 5: Spatial distribution of employment change of new businesses (mean values percentage 1987 – 2002)

businesses and in the incumbents is close to zero (0.05) (see table A1 in the Appendix). Hence, the weighted employment change in new businesses diverges more pronounced from the pattern that is found for the change of overall and incumbent employment. The marked differences in contribution of new and incumbent businesses to overall employment change (figure 4 and 5) suggest that start-ups assume distinct roles in regional growth regimes (Audretsch and Fritsch, 2002).

5. Variables and estimation approach

In order to analyze the effect of new business formation on employment change in young and in incumbent businesses, we regress the average start-up rate of the previous ten years on the different measures of employment change.

The relationship between the measures of employment change and entrepreneurial activity is specified as

$$\Delta \ln EMP_{r,t} = \beta_0 + \mu_r + \lambda_t + \beta_1 \ln startuprate_{r,t-1} + X_{r,t-1} + \varepsilon_{r,t}$$

where $\Delta \ln EMP_{r,t}$ is the respective employment change (total / in incumbents / in new businesses) in region r, μ_r is regional fixed effect, λ_t a time fixed effect, and $X_{r,t-1}$ are the other exogenous variables. The lagged start-up rate is calculated as a moving average over a period of ten years in order to allow for the time lag that has been identified in previous analyses (Fritsch and Mueller 2008). Since the main interest of our analysis is to compare the effects of new business formation on employment in young businesses and in the incumbents, the start-up rate is the key independent variable in our model. Since we use the logarithm of the long-run start-up rate, the coefficients can be interpreted as quasi-elasticities and, thus, allows easy comparisons between the regressions.

The start-up rate is calculated according to the labor market approach, i.e. the number of start-ups per period is divided by the number of persons in the regional workforce at the beginning of the respective period. The regional composition of industries has a

considerable effect on the relative importance of start-ups and incumbents. Particularly, regions with a large share of industries where new businesses play an important role tend to have relatively high start-up rates while start-up rates are lower in regions with a high proportion of industries in which the level of new business formation is comparatively low. Moreover, industry characteristics and trends may influence employment change of new businesses and of incumbents and, thereby, the overall development of a region (Peneder, 2002).

We apply the following strategy to account for possible effects of the regional industry structure:

- First, we calculate a sector-adjusted start-up rate in order 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 start-up measure adjusts the raw data by imposing the same composition of industries upon each region.[6]

- Second, in order to control for the influence of the regional industry structure of existing businesses, we include the regional employment shares of 18 out of 19 private industries as control variables.

The consideration of a sector-adjusted version of the start-up rate has the advantage that it does not only account for the regional industry structure of existing businesses (as we do when controlling for the regional industry structure), but additionally it takes into account the industry structure of the new businesses as well. Based on regional data from Germany, Noseleit (2009) emphasizes the importance of

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[6] Our analysis shows that this procedure leads to somewhat clearer results and higher shares of explained variance than estimates with the non-adjusted start-up rate. However, the basic relationships are left unchanged.

regional differences in the industry structure of new businesses for regional growth. Therefore, using start-up rates without accounting for the sectoral composition of entries could lead to a considerable bias.

To test for differences in the employment effects between those start-ups that survive a certain period of time and new businesses that exit relatively soon, we calculate start-up rates including only those new businesses that survived four years and longer (long-term survivors) and start-up rates based only on entries that survived less than four years (short-term survivors). A four-year survival threshold was used since, on the one hand, start-up rates for very short-lived entries may, in some regions, be based on rather small numbers which can lead to erratic values. Since, on the other hand, each additional year of the survival threshold results in a reduction of years with available information in our panel, this time period should not be too long. An analysis based on the same data that we use here (Schindele and Weyh, 2010) showed that on average somewhat more than 30 percent of all start-ups did not survive longer than four years.

In order to control for the effect of regional human capital on innovation and growth (Lucas, 1988; Romer, 1990; Aghion and Howitt, 1998), we include the share of workers with a tertiary degree. Employment density (total employment over area size in km²) is incorporated to account for several types of region-specific influences such as the level of local knowledge spillovers (Glaeser, et al. 1992), house prices, thickness of local markets, etc. Since regional growth may not only be determined by factors within the respective region but also by spatial proximity to other regions, we include a Harris-type market potential function that is defined as the distance weighted sum of total population in all other districts (see Redding and Sturm 2004; Südekum 2008). This variable particularly accounts for spatial dependencies among regions. Industry shares of 18 out of 19 private industries account for differences in factor input combinations and industry-specific trends (Peneder 2002). We apply fixed effects panel

regression in order to control for unobserved region-specific
characteristics.

Table 2: Definition of independent variables and expected signs for their effect
on regional employment change

Variable	Definition
Average start-up rate (log), t-1	Average number of start-ups in a region over the regional workforce (10 years moving average).
Average start-up rate of entries which survive four years or longer (log), t-1	Average number of start-ups in a region that survived at least four years over the regional workforce (10 years moving average).
Average start-up rate of entries with less than four years of survival (log), t-1	Average number of start-ups in a region that survived less than four years over the regional workforce (10 years moving average).
Highly skilled employment share (log), t-1	Share of employees in a region with tertiary education.
Employment density, t-1	Number of employees (in thousands) in a region per square kilometer.
Market potential (log), t-1	Distance-weighted sum of total employment in all other regions.
Industry composition	Share of employees in 18 out of 19 private industries.

In models with total employment change and with employment in
newly founded businesses as dependent variable, we expect a positive
coefficient for the start-up rate. In models which try to explain
employment change in the incumbent businesses, the coefficient of the
start-up rate indicates the direction and the magnitude of the indirect
employment effects. If the indirect effects of new business formation on
the incumbents is mainly a displacement of incumbents, the coefficient
of the start-up rate should have a negative value. If positive supply-side
effects prevail, the coefficient of the start-up rate should be positive.
Should the jobs in the newly founded businesses be the only
contribution of start-ups to regional employment or if positive and

negative indirect effects are of about the same magnitude, the coefficient can be expected to be non-significant. By comparing the coefficients for employment change in the start-ups and in the incumbents, we can assess the relative magnitude of the direct and the indirect effects of new business formation.

Table 2 summarizes the definitions of the independent variables used in the analysis. Table A1 in the Appendix provides descriptive statistics and table A2 shows correlation coefficients for the statistical relationships between the variables.

6. Results

The long run start-up rate has a significantly positive effect on overall employment change as well as on employment change in the new and in the incumbent businesses (model I-III in table 3). The positive coefficient for employment change in the incumbents clearly indicates that the supply-side effects of new business formation outweigh their displacement effects, confirming earlier results (Fritsch, Noseleit, and Schindele, 2010; Fritsch and Noseleit, 2009). Comparing the estimated coefficient for the start-up rate in the model for employment change in incumbents (model II) with the respective coefficient in the model for employment change in the young businesses (model III) shows that the effect of start-ups on employment change in the incumbents is considerably stronger. This suggests that the indirect employment effects of new business formation are more pronounced than the employment in the newly created entities. Looking at the effect of start-ups that survived at least four years (model IV-VI), we see only slight differences compared to the effect of all start-ups. This suggests that the main employment effects (direct and indirect) are mainly driven by start-ups that survive for a certain period of time. The effect of start-ups which survived less than four years (model VII-IX) is, in contrast, considerably smaller than the estimated effects for all start-ups or for start-ups that survived longer than four years. When including both the

Table 3: The impact of sector adjusted start-up rates on total employment change, employment change in incumbent businesses, and employment change in new businesses

Employment change / Independent variables	Total (I)	Incumbents (II)	New businesses (III)	Total (IV)	Incumbents (V)	New businesses (VI)	Total (VII)	Incumbents (VIII)	New businesses (IX)	Total (X)	Incumbents (XI)	New businesses (XII)
Average sector adjusted start-up rate (log), t-1	0.195*** (0.026)	0.158*** (0.026)	0.0374** (0.016)	—	—	—	—	—	—	—	—	—
Average sector adjusted start-up rate of entries which survive four years or longer (log), t-1	—	—	—	0.194*** (0.028)	0.159*** (0.028)	0.0355** (0.016)	—	—	—	0.214*** (0.027)	0.164*** (0.028)	0.0501*** (0.018)
Average sector adjusted start-up rate of entries with less than four years of survival (log), t-1	—	—	—	—	—	—	0.00964 (0.0060)	0.0133** (0.0054)	-0.00370 (0.0036)	-0.0119** (0.0054)	-0.00318 (0.0050)	-0.00874** (0.0038)
Share of highly qualified employees (log), t-1	0.0743** (0.035)	0.0555* (0.032)	0.0187** (0.0084)	0.0766** (0.035)	0.0573* (0.032)	0.0193** (0.0084)	0.0865** (0.036)	0.0636* (0.033)	0.0230*** (0.0082)	0.0793** (0.035)	0.0580* (0.032)	0.0213** (0.0082)
Employment density, t-1	-0.00919 (0.10)	0.0861 (0.088)	-0.0953** (0.036)	0.00293 (0.10)	0.0969 (0.087)	-0.0940** (0.036)	-0.101 (0.13)	0.0224 (0.098)	-0.123** (0.047)	-0.00713 (0.10)	0.0943 (0.087)	-0.101*** (0.037)
Market potential (log), t-1	0.229*** (0.066)	0.112 (0.068)	0.117** (0.046)	0.237*** (0.067)	0.119* (0.069)	0.118** (0.046)	0.198** (0.076)	0.103 (0.077)	0.0955** (0.046)	0.210*** (0.067)	0.112 (0.072)	0.0981** (0.045)
Constant	-1.411** (0.61)	-0.556 (0.64)	-0.855** (0.43)	-1.382** (0.62)	-0.531 (0.64)	-0.852* (0.43)	-1.866** (0.73)	-1.058 (0.74)	-0.808* (0.43)	-1.068* (0.62)	-0.447 (0.68)	-0.621 (0.43)
Year dummies	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]
Control for industry structure	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]	Yes[a]
Log-likelihood	3447	3440	4008	3445	3440	4008	3405	3415	4004	3447	3440	4011
F-test	317.5	106.2	113.9	320.1	105.5	116.5	262.5	93.84	112.7	335.2	105.2	127.2
Pesaran's test for cross sectional independence (p-value)	0.691 (0.49)	0.596 (0.55)	1.456 (0.15)	0.602 (0.55)	0.505 (0.61)	1.450 (0.15)	0.091 (0.93)	0.374 (0.71)	1.574 (0.12)	0.33 (0.74)	0.522 (0.60)	1.498 (0.13)
R-squared (within)	0.754	0.647	0.602	0.753	0.647	0.602	0.736	0.631	0.600	0.754	0.647	0.604

Notes: Fixed effects regressions. Robust standard errors in parentheses. The number of regions is 74 over 16 years resulting in 1,184 observations. *** Statistically significant at the 1 percent level; ** statistically significant at the 5 percent level; * statistically significant at the 10 percent level. a: jointly significant at the 1 percent level.

Table 4: Comparison of direct and indirect effects

Sector adjusted start-up rates	Employment change in		
	incumbents	new businesses	Difference (chi2-value in parentheses)
Average sector adj. start-up rate (log), t-1 (column 2 and 3 of table 3)	0.158	0.0374	0.1206*** (14.97)
Average sector adj. start-up rate of entries which survive four years or longer (log), t-1 (column 11 and 12 of table 3)	0.164	0.0501	0.1139*** (9.40)
Average sector adj. start-up rate of entries which survive less than four years (log), t-1 (column 11 and 12 of table 3)	-0.00318	-0.00874	-.0056 (0.47)

Notes: *** Statistically significant at the 1 percent level; ** statistically significant at the 5 percent level; * statistically significant at the 10 percent level.

Table 5: Comparison of the employment growth effects of start-ups that survived four years and longer vs. start-ups that survived less than four years

	Sector adjusted start-up rates		
	Survival of four years or longer	Survival of less than four years	Difference (F value in parentheses)
Total employment change (column 10 of table 3)	0.214	-0.0119	0.233*** (62.369)
Employment change in incumbents (column 11 of table 3)	0.164	-0.00318	0.1672*** (32.09)
Employment growth in new businesses (column 12 of table 3)	0.0501	-.00874	0.04136*** (8.50)

Notes: *** Statistically significant at the 1 percent level; ** statistically significant at the 5 percent level; * statistically significant at the 10 percent level.

start-up rate of businesses surviving longer than four years as well as the start-up rate of businesses surviving less than four years (model X to XII), we find a significant positive impact of the long-term survivors and a significant negative impact of short-term survivors on total

employment change (model X). The full model also reveals that the negative impact of the short-term survivors on overall employment change (model X) is mainly driven by the relatively low employment in new businesses than results from high rates of start-ups that fail within the first four years (model XII). If the long-term survivors are included then the effect of the short-term survivors on incumbent employment is insignificant (model XI).

Chi2-tests reveal that the differences of the estimated effects of overall start-ups on employment in incumbents and in new businesses are statistically significant (table 4) for all start-ups and for the longer-term survivors but not for short-term survivors. The same holds for differences between the effects of short-term and longer-term survivors (table 5).

The results for the control variables are in line with our expectations. The negative sign for population density reflects the relatively unfavorable development of employment in the agglomerated areas during the period of analysis. Since population density is only significant for employment change in new businesses, this might also be an indication for high intensity of competition in agglomerated regions that makes it relatively hard for newcomers to survive. The share of highly qualified employees always has the expected significantly positive effect. The fact that the respective coefficients show higher values for incumbents than for new businesses is probably a result of the newcomer tending to have only relatively low shares of employees with a tertiary degree. As far as a positive impact of highly qualified employees should result from human capital spillovers (Blien, Suedekum, and Wolf, 2006), our estimates suggest that the new businesses benefit from such an effect to a lower degree than incumbents. The industry shares and the time dummies are jointly significant at the 1 percent level. We also applied Pesaran's test for cross-sectional dependence (Pesaran, 2004) but did not find any indication for such an effect.

To test the robustness of the results with respect to the effect of start-ups on employment change in the incumbent businesses, we performed several checks. Primarily we wanted to assure that the results are not driven by those regions that have an industry structure that is dominated by either incumbent businesses or newcomers. Table 6 reports the regression results where we excluded the upper quartile (model I) and lower quartile (model II) of regions with the highest share of employees in incumbent businesses. As a further robustness check, we run separate regressions at the level of districts; however, the reported results do not change (results available on request).

Table 6: Robustness checks

	I	II
Average sector adjusted start-up rate (log), t-1 to t-10	0.152*** (0.027)	0.180*** (0.028)
Share of highly qualified employees (log), t-1	0.0576*** (0.016)	0.0566*** (0.015)
Employment density, t-1	0.120 (0.085)	-0.0303 (0.089)
Market potential (log), t-1	0.101 (0.084)	0.0608 (0.085)
Constant	-0.447 (0.80)	-0.0762 (0.78)
Year dummies	Yes[a]	Yes[a]
Control for industry structure	Yes[a]	Yes[a]
Log-likelihood	2526	2565
F-test	33.49	41.78
Pesaran's test for cross sectional independence (p-value)	0.384 (0.70)	0.162 (0.87)
R-squared (within)	0.618	0.669
Number of observations (regions / years)	880 (55 / 16)	880 (55 / 16)

Notes: Fixed effects regressions. Robust standard errors in parentheses*** Statistically significant at the 1 percent level; ** statistically significant at the 5 percent level; * statistically significant at the 10 percent level. a: jointly significant at the 1 percent level.

7. Conclusions

We have analyzed the effects of start-up activity on measures for employment change in new and in incumbent businesses. We find evidence for a positive impact of start-up activity on regional employment growth. This positive impact does not only come from employment that is generated in the start-ups itself. In fact, we are able

to show that start-ups also have a significantly positive indirect effect on incumbent employment and that this effect on incumbents is significantly more pronounced than the employment that is created by the newcomers. In this respect, our results confirm earlier research that proved the importance of start-up activity for employment growth in incumbents (Fritsch and Noseleit, 2009). We could also show that particularly those start-ups that are strong enough to remain in the market for a certain period of time are responsible for the positive impact on employment in the incumbents. 'Mayflies' which have to exit the market shortly after entry, tend to have only a small employment effect which can be even negative.

These findings have important implications for further analyses of the effects of new business formation as well as for public policy. Obviously, focusing solely on the evolution of the new businesses while neglecting the consequences for the incumbents is not an appropriate approach for investigating the issue. For a better understanding of the effects of start-ups on development it is essential to regard the new businesses as in integral part of the market process. As markets can have rather different characteristics, the effects of entry may vary considerably according to these market specificities such as minimum efficient size, the stage of the product life cycle, the technological regime, etc. Still, not much is known about the role of market characteristics for the impact of new businesses on the development of the market in terms of productivity, efficiency, adjustment to environmental conditions, innovation, and product variety. The analyses of effects of new business formation on regional development have an important policy implication regarding the market mechanism as a selection procedure. If the market does not work according to a survival of the fittest scenario, the competitiveness enhancing supply-side effects will not occur. If the market selection process does not function sufficiently well, entry will be more or less ineffective or even result in a decrease of welfare. Therefore, the highest priority of any policy towards entry is to secure a smooth and reliable selection of the fittest

scenario. Particularly, policy should avoid anything that may distort this selection process. In this context, support of entries is a rather critical issue. Therefore, any policy that supports new firms after they have been set up may be considered as being questionable. Policy directed at stimulating entry may try to fuel the entrepreneurial spirit, provide advice for nascent entrepreneurs, lower administrative hurdles for start-ups, etc. – however, it should abstain from any interference with fair competition.

The finding that the indirect effects of new business formation are quantitatively larger than the direct effects does *not* mean that the employment in the new businesses is unimportant. The indirect effects emerge through the interaction between the newcomers and the incumbents and would not occur without the start-ups challenging the incumbents. New businesses are the necessary but not the sufficient precondition for a positive effect on regional employment and development. Further research is needed to find out more about the factors that determine these employment effects. The result that particularly those start-ups have significant employment effects, which are competitive enough to survive on the market for a period of four years or longer, suggests that the quality of the new businesses plays an important role. Obviously, it is the well-prepared start-ups that constitute a serious challenge for the incumbents and that are drivers of economic development, not those entries that have to leave the market after only a short period of time. This issue also deserves further investigation.

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Appendix

Table A1: Descriptive statistics for variables used in the empirical models

Variable	Mean	Median	Minimum	Maximum	Standard deviation
Total employment change	0.0004	0.00057	0.0273	-0.1559	0.2431
Employment change in incumbent businesses	-0.0211	-0.0222	0.0231	-0.1826	0.1919
Employment change in new businesses	0.0215	0.0204	0.0135	-0.0329	0.0812
Average sector adjusted start-up rate (log), t-1	-4.8833	-4.8934	0.2117	-5.3893	-4.1518
Average sector adjusted start-up rate of entries with four and more years of survival (log), t-1	-5.4122	-5.4198	0.2041	-5.9079	-4.7301
Average sector adjusted start-up rate of entries with less than four years of survival (log), t-1	-5.7057	-5.7137	0.3728	-6.8067	-4.6157
Share of highly qualified employees (log), t-1	-2.9256	-2.9631	0.3795	-3.8764	-1.7506
Employment density, t-1	0.0904	0.0475	0.1215	0.0131	0.8397
Market potential (log), t-1	9.3611	9.1212	1.0288	7.5851	12.0639
Share of employees in incumbent businesses, t-1	0.7728	0.7803	0.0501	0.6026	0.8804

Table A2: Correlations among variables

		1	2	3	4	5	6	7	8	9	10
1	Total employment change	1									
2	Employment change in incumbent businesses	0.8691	1								
3	Employment change in new businesses	0.536	0.0483	1							
4	Average sector adjusted start-up rate (log), t-1	-0.0394	-0.1144	0.1156	1						
5	Average sector adjusted start-up rate of entries with four and more years of survival (log), t-1	-0.0205	-0.0886	0.1097	0.9947	1					
6	Average sector adjusted start-up rate of entries with less than four years of survival (log), t-1	0.0675	-0.0291	0.1859	0.5302	0.5493	1				
7	Share of highly qualified employees (log), t-1	-0.1348	-0.2502	0.1549	-0.2152	-0.269	0.0492	1			
8	Employment density, t-1	-0.0538	-0.0762	0.0215	-0.3988	-0.4202	-0.0106	0.4917	1		
9	Market potential (log), t-1	0.039	0.0272	0.0324	0.3243	0.3557	0.5003	-0.1842	-0.0394	1	
10	Share of employees in incumbent businesses, t-1	0.1106	0.2177	-0.1486	-0.6166	-0.6014	-0.7776	-0.1767	0.027	-0.3037	1