JENA ECONOMIC RESEARCH PAPERS

2011 – 001

Does Quality Make a Difference? Employment Effects of High- and Low-Quality Start-Ups

by

Michael Fritsch
Alexandra Schroeter

www.jenecon.de

ISSN 1864-7057

The JENA ECONOMIC RESEARCH PAPERS is a joint publication of the Friedrich Schiller University and the Max Planck Institute of Economics, Jena, Germany. For editorial correspondence please contact markus.pasche@uni-jena.de.

Impressum:

Friedrich Schiller University Jena
Carl-Zeiss-Str. 3
D-07743 Jena
www.uni-jena.de

Max Planck Institute of Economics
Kahlaische Str. 10
D-07745 Jena
www.econ.mpg.de

Does Quality Make a Difference? Employment Effects of High- and Low-Quality Start-Ups

Michael Fritsch

Alexandra Schroeter

January 2011

Abstract

This paper investigates the impact of new firms' quality on the magnitude of their employment effects. Our results clearly show that the quality of start-ups, measured by their affiliation with sectors and innovative industries, strongly influences the direct and the overall employment contribution of new firms. In particular, start-ups in manufacturing industries generate larger direct and overall growth effects than those in services. Moreover, new businesses in innovative manufacturing and in knowledge-intensive service industries make a larger direct contribution to employment than start-ups affiliated with other industries. We also find a relatively strong overall effect of new business formation in knowledge-intensive service industries. However, the impact of start-ups in innovative manufacturing industries on overall regional employment growth is not statistically significant, which may be mainly due to their rather small share in all start-ups and because they impact more on firms and employment in other regions than do start-ups in non-innovative manufacturing. Finally, we discuss the implications for entrepreneurship policy that can be derived from our findings.

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

Keywords: Entrepreneurship, new business formation, innovative industries, regional development, entrepreneurship policy

Address for correspondence:

Prof. Michael Fritsch
Dr. Alexandra Schroeter
Friedrich Schiller University Jena
School of Economics and Business Administration
Carl-Zeiss-Str. 3
D-07743 Jena, Germany

m.fritsch@uni-jena.de, alexandra.schroeter@uni-jena.de

1. Aims and scope*

Recent empirical evidence suggests that the magnitude of the effect of new business formation on employment and economic growth is closely related to the quality of new businesses.[1] With regard to the effects on economic development, the quality of a start-up can be generally understood as the intensity of competitive pressure it brings to bear on incumbents. This competitive challenge can be regarded as the main driving force behind the effect new businesses have on economic development (for an overview, see Fritsch, 2008). The quality of a new business may be indicated by factors such as the innovativeness of its goods and services, the qualification of the entrepreneur, the marketing strategy pursued, and the amount and quality of resources mobilized, as well as by its productivity.

The present paper investigates the link between the quality of new businesses and the magnitude of their employment effects for West German regions in the 1988–2002 period. The quality of start-ups is measured by their affiliation to broad economic sectors (manufacturing and services) as well as to innovative industries.[2] We analyze the employment contribution of new ventures by distinguishing between the employment development in entry cohorts, which represents their direct

---

* We are particularly indebted to Niels Bosma, Florian Noseleit and Viktor Slavtchev for helpful comments on an earlier version of this paper.

[1] E.g., Baptista and Preto (2011), Falck (2007), Fritsch and Noseleit (2009b), Engel and Metzger (2006), and Metzger and Rammer (2009).

[2] Another aspect of the quality of new businesses is their competitiveness in terms of survival on the market. At the industry level, Falck (2007) finds 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. Fritsch and Noseleit (2009b) confirm this result at the regional level. According to their analysis, start-ups that survived four years or longer had a significantly positive effect on employment growth, while the effect of new businesses that survived less than four years was insignificant or even significantly negative.

employment effect, and their overall impact on growth, including their indirect effect. Our basic hypotheses are that

(a) cohorts of high-quality start-ups have a relatively strong direct employment effect, i.e., they create comparatively more jobs than other new firms, and

(b) high-quality start-ups are a stronger challenge to incumbent suppliers and, therefore, generate stronger overall effects on regional development than their lower-quality counterparts.

Section 2 explains in more detail why the quality of a start-up should make a difference to employment effects and provides an overview of the extant relevant empirical evidence. Section 3 focuses on data and measurement issues. The results of the empirical analysis are presented in Section 4 and the final section (Section 5) discusses implications for policy, as well offering some suggestions for further research.

2. Why should the quality of an entry be important for its employment effects?

Recent empirical studies have shown that the effect of new business formation on regional development occurs over a longer period of time.[3] Typically, the effects take place over several phases. In the first phase, setting-up of new businesses obviously leads to an employment increase because extra personnel are needed to begin operations. This can be regarded as the *direct employment effect* of new businesses. However, there are two other effects that new businesses may have on employment. One of these is the *displacement effect*, which results from competition between new and incumbent businesses on input as well as on output markets. The entry of new ventures spurs market

[3] Audretsch and Fritsch (2002), Fritsch and Mueller (2004, 2008), Acs and Mueller (2008), Mueller et al. (2008), van Stel and Suddle (2008), Baptista et al. (2008), and Arauzo-Carod et al. (2008).

selection and as long as this market selection process works according to a “survival of the fittest” scenario, the least productive firms will either reduce their level of economic activity or exit the market. Because such a scenario leads to a rise in average productivity, employment should decrease as long as output remains constant. There are, however, several ways competition by entry of new businesses can stimulate improvements on the supply side of the regional economy that may lead both to improved competitiveness and higher employment levels. The main *supply-side effects* of entry can include securing efficiency by contesting established market positions, accelerating structural change, amplifying innovation, and the provision of a greater variety of products and problem solutions (for a more detailed exposition, see Fritsch, 2008). These supply-side effects are why one should expect positive employment effects of new business formation.

Hence, new businesses may lead to employment growth because they stimulate competition by challenging incumbents. The effect of entries on economic growth depends on the competitive pressure that new firms exert on incumbents as well as on the incumbents’ response. This means that improvement may occur on the start-up side as well as on the incumbent side and, therefore, it is not completely necessary that the newcomers be successful and survive in order for them to make a contribution. Therefore, the development of new businesses, as measured by employment in start-up cohorts, reflects only a part of their effect on growth. In addition, displacement and supply-side effects need to be considered in assessing the overall contribution of new business formation to growth. In fact, Fritsch and Noseleit (2009a, 2009b) show that the indirect effects of new business formation are quantitatively much more important than the direct effects.

New businesses may vary considerably in the degree of challenge they pose to incumbents. This challenge is closely related to the quality of the new ventures, which can be indicated by various factors such as

the innovativeness of their goods and services, the qualification of the entrepreneur, the amount and quality of mobilized resources, and the marketing strategy pursued, as well as by their productivity. Recent empirical studies suggest that start-ups in manufacturing generate a stronger overall employment effect than new businesses in other economic sectors (e.g., van Stel and Suddle, 2008). This is particularly remarkable because entry into manufacturing industries is relatively rare due to high entry barriers in terms of minimum efficient size and capital intensity. However, these high entry barriers may induce a higher quality of entries due to a self-selection of potential entrepreneurs, which could explain the comparatively larger economic effect of start-ups in manufacturing industries. Additionally, purely imitative entry of suppliers that simply replicates already available products using identical production processes and, consequently, maintains the same cost and price level, represents a far lesser challenge than innovative start-ups with completely new products or production processes that lower cost and maybe prices considerably. It is, therefore, not farfetched to assume that innovative entries may have a larger positive effect on growth than start-ups that are entirely imitative (for a more detailed exposition of the argument, see Fritsch and Schroeter, 2009).

There are only a few empirical studies investigating the employment effect of start-ups differentiated by their sector affiliation or innovativeness. Concerning the direct employment effect of new businesses, empirical analyses for Germany provide evidence that the number of employees in start-up cohorts rises in the first one or two years but then declines quite quickly and even falls below the initial employment level after about eight years. This general pattern, however, varies greatly between sectors. The number of employees in cohorts of manufacturing start-ups becomes larger and remains above the initial employment level for a longer period of time than is the case in services (Fritsch and Weyh, 2006; Schindele and Weyh, 2011).

One may well assume a particularly positive employment development for innovative new ventures compared to non-innovative start-ups as they profit from a new and growing demand for their innovative products or services. Nevertheless, innovations are always prone to uncertainty as to market success and, if they involve R&D, also with respect to the success, cost, and duration of the R&D. But if innovative firms survive, it is plausible to expect them to grow rapidly. Empirical results on the survival of innovative firms are, however, mixed. Studies by Audretsch (1995) for the United States and by Audretsch et al. (2000) for the Netherlands indicate a relatively greater risk of failure for start-ups in industries with high R&D levels. In contrast, using data from the ZEW Founder Panel, Metzger and Rammer (2009) present evidence for somewhat higher survival rates for new ventures in innovative than in other industries in Germany. The results of Metzger and Rammer (2009) also suggest that new businesses in German innovative manufacturing industries and knowledge-intensive services create on average more jobs per start-up than entries in non-innovative and non-knowledge-intensive industries.

To assess the overall growth impact of new firms, Audretsch et al. (2006) include the start-up rate (number of start-ups over population) in a regional production function as an input together with capital, labor, and R&D investment. In their analysis for West Germany, they find that start-ups in high-tech industries and in the information and communication industries had a statistically significant impact on the regional level of output as well as on the level of labor productivity. The coefficients for start-ups in these industries for explaining regional GDP were smaller than for start-ups in all industries. However, when labor productivity is used as a dependent variable, the coefficient for high-tech entrepreneurship was higher. Causal interpretation of these results is problematic, however, since the empirical analyses are limited to the *level* of GDP and productivity, not to their development.

Analyzing the overall effect of new business formation on regional employment for Portuguese regions, Baptista and Preto (2011) find that the overall effect of on regional employment is substantially larger for businesses in knowledge-based industries than for start-ups in other industries. Particularly, the displacement effects as well as the supply-side effects of new businesses in knowledge-based industries were much more pronounced than in non-knowledge-intensive industries.

3. Data and measurement

Our analysis of the effect of new business formation on regional economic development over time is at the spatial level of West German planning regions (*Raumordnungsregionen*). Planning regions consist of at least one core city and the surrounding area. 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 to work areas and that they account for economic interactions between districts. Planning regions are slightly larger than what is usually defined as a labor market area. In contrast to this, a district may be a single core city or a part of the surrounding suburban area (for the definition of planning regions and districts, see Federal Office for Building and Regional Planning, 2003). We excluded East Germany from our study since many analyses show that developments in East Germany in the 1990s were strongly shaped by that region's transformation to a market economy. Therefore, East Germany is a rather special case that should be analyzed separately (e.g., Kronthaler, 2005). The Berlin region was also excluded due to changes in its geographic definition after German reunification in 1990.[4]

[4] For historical reasons, the cities of Hamburg and Bremen are defined as planning regions even though they are not functional economic units. To avoid possible distortions, we merged these cities with adjacent planning regions (Hamburg with the region of Schleswig-Holstein South and Bremen with Bremen-Umland). We thus have 71 regions in our sample.

The data used in this study stem from the Establishment History Panel, which is based on official employment statistics. It is provided by the Institute for Employment Research (IAB) of the Federal Employment Agency (see Spengler, 2008, for details). This database is comprised of information on all establishments that have at least one employee subject to obligatory social insurance. Because the database records only businesses with at least one employee, start-ups consisting of only owners are not included. Unfortunately, the database is completely at the establishment level and thus does not allow us to separate new firms from new plants and branches created by existing firms. To avoid distortions caused by new large subsidiary plants of incumbent firms, new establishments with more than 20 employees in the first year of their existence are not counted as start-ups.[5] In addition, we excluded start-up and employment data in agriculture and fishery, energy, mining, railway, and postal services because of their highly regulated market conditions that strongly diverge from the rest of the economy. Data on population and population density are from the German Federal Statistical Office.

New business formation activity is measured by yearly start-up rates calculated according to the labor market approach; namely, the number of start-ups per period is divided by the number of employees in the regional workforce (in thousands) at the beginning of the period. Start-ups are classified as innovative or non-innovative according to their affiliation with certain industries. This classification is mainly based on the knowledge and R&D intensity of industries as well as on the innovativeness of their products (Grupp and Legler, 2000). Manufacturing industries are classified as innovative if their R&D intensity, i.e., the ratio of R&D expenditures to sales, is 3.5 percent or higher. Since many service firms do not have a standardized product

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

program but provide support according to the individual needs of their customers, they are not innovative in the same sense as manufacturing firms. Hence, service industries that may be relevant for innovation processes are entirely defined according to the knowledge intensity of their inputs. These knowledge-intensive service industries include, for example, “computer services,” “research and development in natural sciences and engineering,” and “business consultancy” (see Table A1 in the Appendix).

Table 1: Average start-up rates and shares of start-ups in different types of industries

	All start-ups	Start-ups in manufacturing	Start-ups in services
Start-up rate	9.98	2.16	7.82
Share in all start-ups (%)	100	22.97	77.02
Start-up rate in innovative manufacturing	-	0.26	-
Start-up rate in knowledge-intensive services	-	-	1.10
Share of start-ups in innovative manufacturing (in %)	2.79	12.10	-
Share of start-ups in knowledge-intensive service industries (in %)	11.02	-	14.28

On average, there were about 9.98 new businesses per 1,000 employees set-up in the period under inspection (1988 to 2002). The start-up rate in services was about 7.82, and only 2.16 in manufacturing (Table 1). Start-ups in innovative manufacturing and knowledge-intensive services were much less frequent, with rates of 0.26 and 1.10, respectively. New firms in knowledge-intensive service industries account for only about 11 percent of all start-ups and 14.28 percent of

all new ventures in services. New firms in innovative manufacturing industries represent a share of only 2.79 percent of all start-ups and 12.1 percent of all new businesses set up in the manufacturing sector. Hence, new businesses in innovative manufacturing industries are very rare (Metzger and Rammer, 2009; see also Licht and Nerlinger, 1998, for the period 1985–1992).

Our indicator for regional development is the average yearly change of employment (*E*) over a two-year period (percentage), i.e., between the current period t_0 and t_{+2}. A two-year average is used so as to avoid the effect of short-term fluctuations. Table A2 in the Appendix provides descriptive statistics and Table A3 shows the correlations between the variables in the analysis. There is considerable correlation between the start-up rates in the different sectors, particularly between start-up rate in services, manufacturing and in knowledge-intensive services.

4. Empirical analysis

In a first step, we analyze the direct employment effect of new business formation. This involves, on the one hand, the development of start-up cohorts differentiated by their affiliation with sectors and with innovative and knowledge-intensive industries. This analysis includes an investigation into the survival rates of new ventures belonging to different sectors and industries as the development of employment in start-ups cohorts is strongly linked to the success and failure of cohort firms. On the other hand, we look at the contribution of these different groups of new firms to overall employment (Section 4.1). In a second step, we assess the overall employment contribution of new businesses in different sectors and different types of industries including direct and indirect effects generated by the new ventures (Section 4.2).

4.1 The direct effect of new business formation on regional employment over time

Our period of investigation, between 1988 and 2002, covers 15 yearly cohorts of new businesses. To identify their general pattern of employment development, we aggregate these cohorts and calculate average values. The development of start-up cohorts in the different industries is presented as indices, with the number of employees in the initial year given by an index level of 100 and the values of subsequent years representing the percentage share of the initial level. This presentation facilitates comparing cohort developments across sectors and industries.

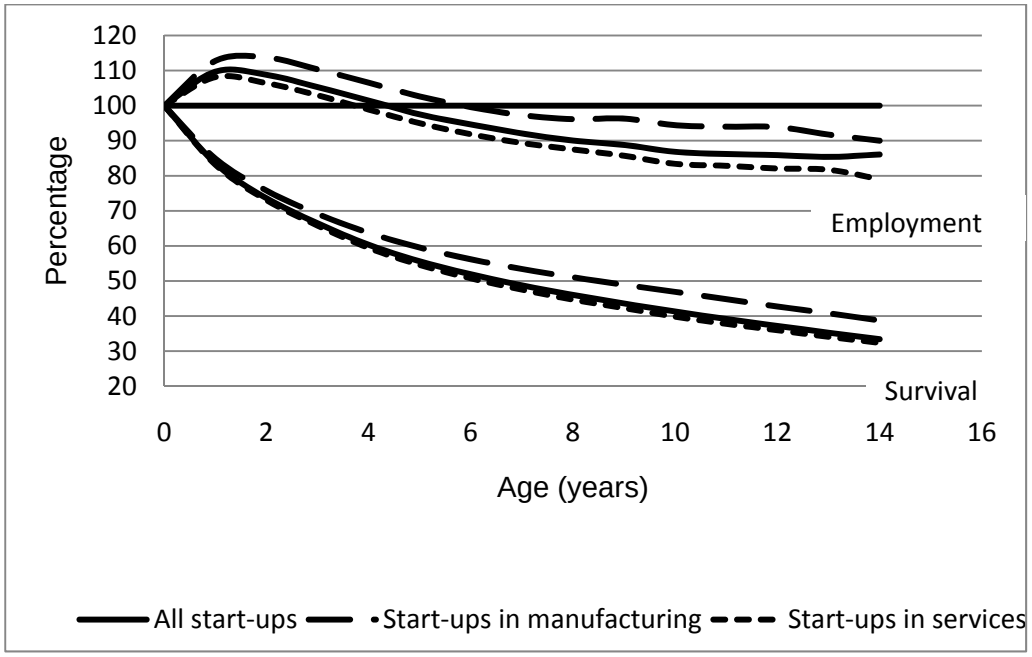

Figure 1: Evolution of employment in entry cohorts of all start-ups, start-ups in manufacturing, and start-ups in services

Figure 1 displays the evolution of entry cohorts of all start-ups as well as of new firms in manufacturing and services. Consistent with previous findings for Germany, start-up cohorts in manufacturing perform much better than those in services (Fritsch and Weyh, 2006;

Schindele and Weyh, 2011). The average number of jobs in manufacturing start-ups reaches a maximum of 114 percent of the initial employment after two years and then declines to the original level six years after foundation. After 15 years, the number of employees is about 90 percent of the initial employment number. In contrast, the highest average employment level of entry cohorts in services amounts to 108 percent in the first year and reaches its basic level as soon as four years after foundation. Since most start-ups occur in the service sector, the cohort development of all start-ups is much weaker than for manufacturing and more resembles that of start-up cohorts in services. The diverging employment development of entry cohorts in manufacturing and services seems to be related to differences in the survival rates of new firms in both sectors. On average, about 59 percent of new firms in manufacturing survive the first five years; this number is about 4 percent lower for new ventures in services. After 15 years, 38 percent of the initial entries in manufacturing are still in the market compared to only 32 percent in services. As for employment development, the survival pattern of entry cohorts in services strongly resembles that of all start-ups since new firms in services make up the vast majority of all new businesses.

Employment development in cohorts of start-ups in innovative manufacturing industries clearly exceeds that of their non-innovative counterparts (Figure 2). Employment in the average start-up cohort in innovative manufacturing industries rises to 121 percent of the initial level in the second year, compared to 109 percent for start-ups in manufacturing industries classified as being non-innovative. Although employment subsequently declines for both groups, the number of jobs in the innovative manufacturing start-ups never falls below the level of the initial year. Moreover, their employment development remains fairly

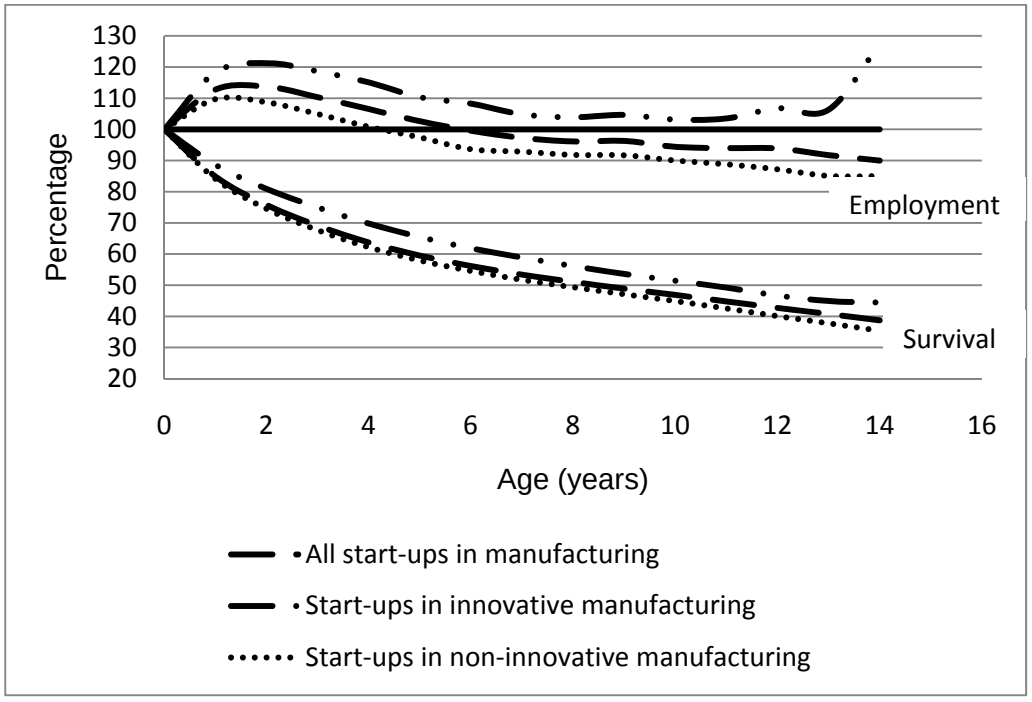

Figure 2: Evolution of employment in entry cohorts of all manufacturing start-ups and start-ups in innovative and non-innovative manufacturing industries

constant after seven years, at about 106 percent of the initial number of employees.[6] By contrast, employment in the average start-up cohort in non-innovative manufacturing industries falls below the initial level after four years and continues to decline until it is about 85 percent of the basic employment level after 15 years. Although the uncertainty associated with innovative business ideas might imply a higher risk of failure for such start-ups, new firms in innovative manufacturing industries experience a higher probability of survival than their non-innovative counterparts, which might be an important reason for their larger job contribution. After five years, 65 percent, and after 15 years, 44 percent, of all new business in innovative manufacturing industries

[6] The sharp increase in the number of jobs after 14 years is caused by the cohort of 1988, which is obviously a special case that should not be generalized.

are still in the market compared to 58 percent and 35 percent, respectively, of all entries in other parts of the manufacturing sector.

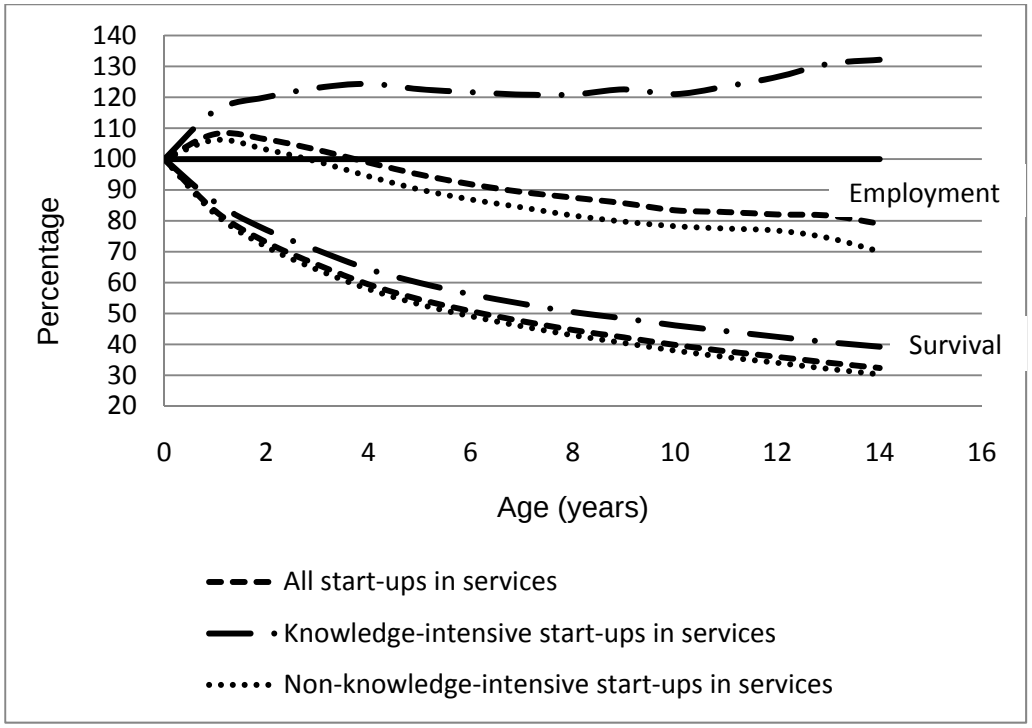

Figure 3: Evolution of employment in entry cohorts of all start-ups in services and start-ups in knowledge-intensive and non-knowledge-intensive services

Comparing the employment development of start-ups in knowledge-intensive and non-knowledge-intensive service industries (Figure 3) reveals that the cohort employment in the first group strongly increases after foundation and reaches 124 percent of the initial level after four years. In subsequent years, the number of employees declines slightly but starts to increase again after 10 years, finally reaching 132 percent of the initial number of jobs. However, the high level of employment in the 14th and 15th year are caused by only two cohorts and thus need to be interpreted with caution. Nevertheless, the number of employees in the average cohort of knowledge-intensive start-ups remains clearly above the initial level and tends to grow across nearly the entire period

of inspection. Moreover, it considerably exceeds the employment contribution of cohorts in innovative manufacturing. This is a remarkable difference, possibly attributable to the growing demand for high-end services as well as to increasing outsourcing of such activities in advanced economies (see, e.g., Peneder et al., 2003; Schettkat, 2007).

Average development of start-up cohorts in non-knowledge-intensive services is characterized by a weak employment increase up to 106 percent of the initial level in the first year. This is followed by a rapid decline back to the initial number of employees after only three years. After 14 years, only about three-quarters of the original number of employees are still employed in the new firms. Similar to the survival pattern of new firms in innovative and non-innovative manufacturing, knowledge-intensive start-ups in services are more successful than non-knowledge-intensive services as 60 percent and 39 percent of them survive the first five and 15 years, respectively, while these rates are about 7 and 9 percent lower for the other group of new ventures. Although new ventures in knowledge-intensive services have a higher probability of failure than those in innovative manufacturing industries, they create on average more jobs within the first 15 years. In contrast, non-knowledge-intensive start-up cohorts in services have lower survival rates and lower employment development compared to entry in non-innovative in manufacturing.

Although the job evolution of entry cohorts in manufacturing industries considerably exceeds that of service industry entrants (Figure 1), the overall employment development of these two large sectors of the German economy for the period 1988 to 2002 shows a quite different picture (Figure 4). The number of jobs in services grew steadily; employment in manufacturing had declined to about 83 percent of the 1988 level by 2002. Within the service sector, an

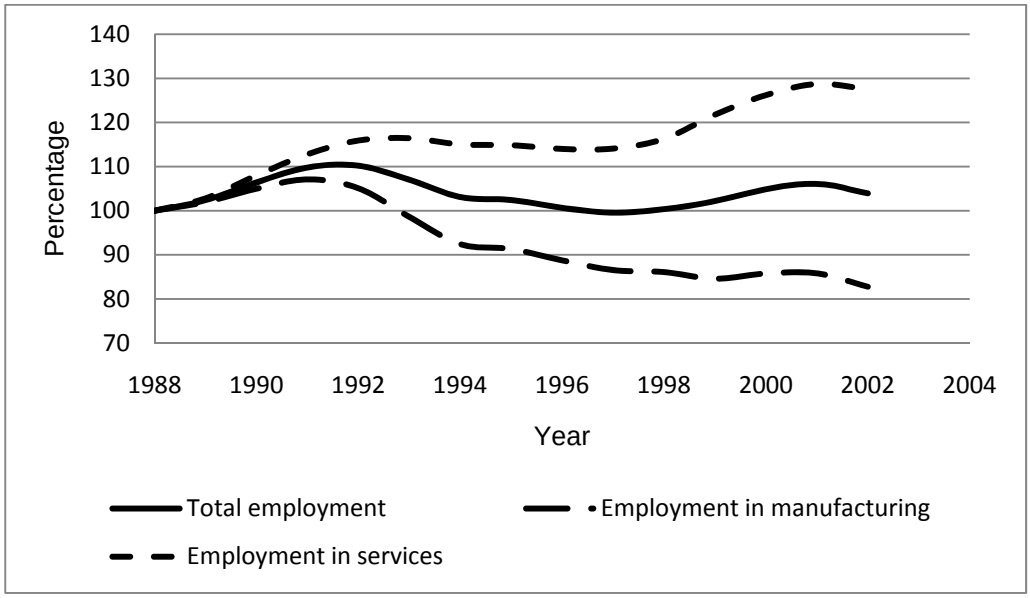

Figure 4: Evolution of total employment and employment in manufacturing and services

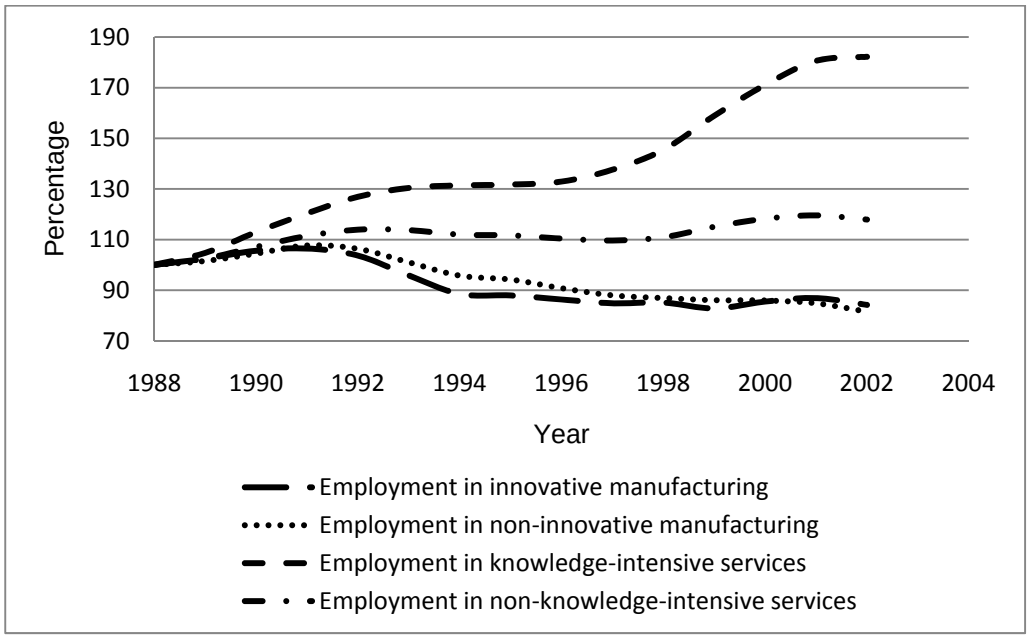

Figure 5: Evolution of employment in innovative and non-innovative manufacturing industries as well as in knowledge-intensive and non-knowledge-intensive service industries

impressive job increase of 82 percent is observed for the knowledge-intensive service industries and employment in non-knowledge-intensive services rises about 17 percent. In contrast, employment in innovative manufacturing and non-innovative manufacturing industries declined steadily between 1988 and 2002 (Figure 5). These shifts in the employment pattern likely indicate the general long-term trend toward the service sector as well as the growing demand for high-end services and increasing outsourcing of knowledge-based activities in advanced economies (see, e.g., Peneder et al., 2003; Schettkat, 2007).

To this point, we have investigated the evolution of employment in entry cohorts as well as their survival. However, to gain insight into the question of whether new business formation leads to employment growth, we now focus on the contribution of different entry cohorts to overall employment. Analyzing the shares in the direct employment effect of new business formation, i.e., the number of jobs that remained in the 15 yearly cohorts at the end of the period under inspection (1988 to 2002), reveals some striking differences between the different groups of start-ups. Figure 6 shows that new firms in manufacturing created roughly 35 percent of all jobs in entry cohorts even though they represent only about 23 percent of all start-ups. The remaining 65 percent of new jobs in new businesses are in service firms, which make almost 80 percent of all new ventures. These statistics clearly show that the manufacturing entries have a stronger direct employment effect than new businesses in the service sector. Such differences of the direct employment effect of new businesses become even more pronounced when distinguishing them by their innovativeness and knowledge intensiveness. Start-ups in innovative manufacturing contribute 16.6 percent to total cohort employment while accounting for only 2.77 percent of all new businesses. New firms in non-innovative manufacturing industries, which make up a bit more than 18 percent of all new businesses, generate about 18.3 percent of all new jobs. Start-ups in knowledge-intensive service industries, which account for 11

percent of all start-ups, create 17.9 percent of all new employment in entry cohorts, while the share of new jobs in non-knowledge-intensive services is about 47 percent, which is considerably less than their share of 66 percent in the number of all start-ups.

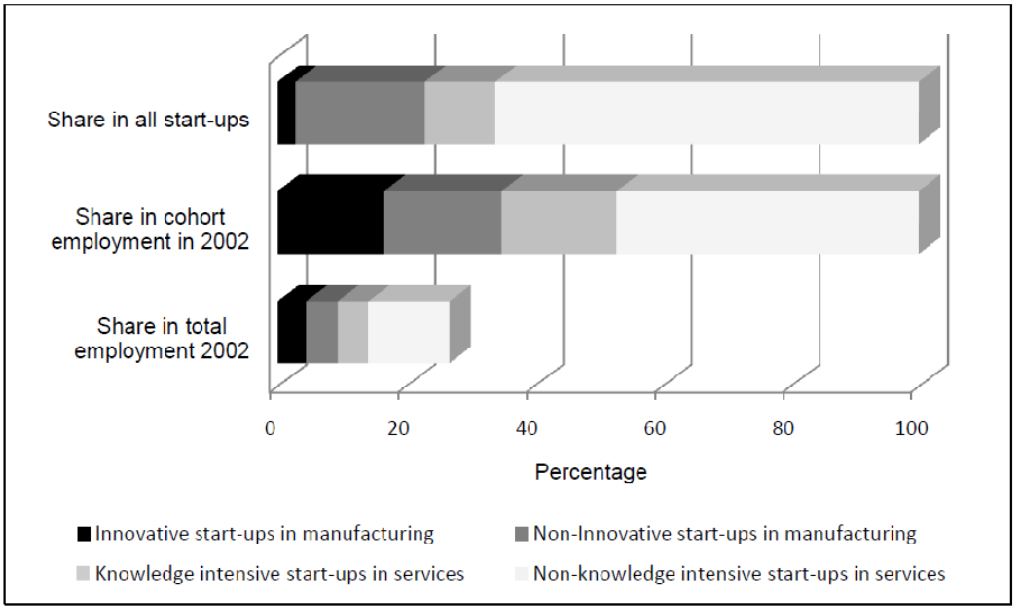

Figure 6: Share of start-ups and employment contribution of start-ups differentiated by their sector affiliation and innovativeness

The share of employees in the 15 yearly entry cohorts at the end of the period under inspection (2002) in total employment amounts to about 27 percent (Figure 6). Most of these new jobs are in new service firms (almost 18 percent of all new jobs in 2002); new manufacturing firms contribute about 9 percent of overall employment in the year 2002. Given their small number, new firms in innovative manufacturing and knowledge-intensive service industries create a relatively large share of overall employment—4.5 and 4.8 percent, respectively. The contribution of new businesses in non-innovative and non-knowledge-intensive industries to overall employment amounts to 4.9 and 12.6 percent, respectively.

The preceding analysis shows that cohorts of high-quality start-ups contribute relatively more to employment growth than do cohorts of their lower-quality counterparts. On the one hand, this is reflected by an employment evolution of high-quality entry cohorts that clearly exceeds those of new businesses of lower quality. On the other hand, given their share in all new firms, high-quality start-ups create a comparatively larger job share both in cohort as well as in total employment. We can thus confirm our first hypothesis that high-quality start-ups create a relatively stronger direct employment effect than start-ups of lower quality.

4.2 The overall employment contribution of new business formation to regional employment over time

Previous analyses of the effects of new business formation on employment over time for Germany (Fritsch and Mueller, 2004, 2008) find a statistically significant effect over a period of 10 years. Therefore, we regresses the start-up rate of the current year (t_0) as well of the 10 preceding years (t_{-1} to t_{-10}) on the average rate of employment change in region r between t_0 and t_{+2}. We estimate:

$$\Delta EMP_{r,t} = \alpha + \beta\ average\quad start\ -up\ rate_{r,t0-t-10} + X_{r,t-1} + \mu_r + \varepsilon_{r,t},$$

where the start-up rate is calculated as a moving average over a period of 10 years to allow for the time lag identified in previous analyses (Fritsch and Mueller, 2008), $X_{r,t-1}$ are other exogenous variables, μ_r is a regional fixed effect, and $\varepsilon_{r,t}$ is the error term. Panel estimation techniques that allowed accounting for unobserved region-specific factors were employed. Application of the Huber–White method provided robust standard error estimates.

The set of other variables ($X_{r,t-1}$) is included to account for factors other than start-ups that are relevant for regional growth. In particular, we include population density as a catch-all variable for a number of local characteristics that might affect regional growth, such as the wage

level, real estate prices, quality of the infrastructure, or qualification and diversity of the labor market. Since human capital is an important determinant of regional growth (Lucas, 1988; Glaeser et al., 1992), we add the regional share of highly-skilled employees, those with a tertiary degree, to our model. To account for the influence of industry structure on employment growth (Glaeser et al., 1992; Peneder, 2002; Combes, 2000), we insert the employment shares of 27 out of 28 aggregated industries in our model. Finally, local employment growth may also be driven by proximity to other markets. Hence, we included a Harris-type market potential function, which is a distance-weighted sum of GDP per population in all other planning regions (Redding and Sturm, 2008; Südekum, 2008). This variable particularly controls for spatial autocorrelation.

Table 2 shows our estimation results for the basic model and for different specifications of it. The effect of start-ups in all industries on regional employment growth is statistically significant at the 1 percent level (Model I). Including only the new businesses in manufacturing (Model II) leads to a considerably higher effect than in the model that contains only the start-ups in services (Model III). However, Models II and III may overestimate the effects of start-ups since they include only start-ups in services or manufacturing. Overestimation of the effects of start-ups in a certain sector may particularly result from the pronounced correlation between the rates for the different sectors (see Table A3 in the Appendix). Hence, to avoid an omitted variable bias, all new ventures should be accounted for. In a model that contains start-ups in services and in manufacturing (Model IV), both indicators are statistically significant, with the effect of new ventures in manufacturing being larger than the effect for start-ups in services. This result is noteworthy since start-ups in manufacturing make up only about 20 percent of all new businesses, whereas start-ups in services account for about 80 percent.

Table 2: Employment effects of new business formation differentiated by the type of new firms

Employment change / Independent variables	I	II	III	IV	V	VI	VII	VIII
Start-up rate all sectors	0.294*** (3.38)	-	-	-	-	-	-	-
Start-up rate in manufacturing	-	0.265** (2.36)	-	0.190** (2.08)	-	-	-	-
Start-up rate in services	-	-	0.216*** (3.42)	0.105* (1.68)	-	-	-	-
Start-up rate in innovative manufacturing industries	-	-	-	-	-0.002 (0.05)	-	-	-0.035 (0.84)
Start-up rate in knowledge-intensive service industries	-	-	-	-	-	0.200*** (2.68)	-	0.172** (2.27)
Start-up rate in non-innovative manufacturing and services	-	-	-	-	-	-	0.198*** (2.83)	0.157** (2.12)
Share of highly-skilled employment	0.054** (2.23)	0.058** (2.46)	0.052** (2.28)	0.054** (2.25)	0.057** (2.38)	0.057** (2.41)	0.053** (2.27)	0.054** (2.32)
Population density	-0.646 (1.21)	-0.452 (0.80)	-0.696 (1.29)	-0.395 (0.70)	-0.652 (1.18)	-0.820 (1.42)	-0.637 (1.18)	-0.727 (1.34)
Market potential	-0.284 (1.04)	-0.210 (0.78)	-0.237 (0.89)	-0.362 (1.54)	0.063 (0.23)	-0.151 (0.58)	-0.187 (0.68)	-0.239 (0.84)
Constant	-0.328 (1.14)	-0.317 (0.97)	-0.388 (1.37)	-0.363 (0.12)	-0.547* (1.75)	-0.534* (1.73)	-0.392 (1.33)	-0.405 (1.38)
Control for industry composition	Yes a)	Yes a)	Yes a)	Yes a)	Yes a)	Yes a)	Yes a)	Yes a)
Time dummies	Yes a)	Yes a)	Yes a)	Yes a)	Yes a)	Yes a)	Yes a)	Yes a)
R-squared	0.71	0.63	0.64	0.73	0.57	0.63	0.67	0.75
Log-likelihood	753.6	751.1	753.1	756.1	726.5	751.7	751.0	767.1
Number of observations	284	284	284	284	284	284	284	284
Number of planning regions	71	71	71	71	71	71	71	71

Notes: Fixed effect panel regression. Robust t statistics 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.

Surprisingly, running our model with only start-ups in innovative manufacturing industries does not reveal any significant impact on regional employment growth (Model V). By contrast, new businesses in knowledge-intensive services (Model VI) have a distinct impact on regional growth (Model VI). Likewise, non-innovative start-ups in services and manufacturing exert a statistically significant influence on employment development that is only slightly smaller than the effect of knowledge-intensive new ventures (Model VII). Including all three indicators in one model reveals a much larger growth effect from knowledge-intensive new firms than that of non-innovative manufacturing and service start-ups. The indicator for start-ups in innovative manufacturing industries remains insignificant (Model VIII). With regard to the control variables, we find a significantly positive effect of human capital intensity on regional employment growth, which is in line with our expectations. The local industry structure also plays a role; however, regional population density and proximity to other markets are insignificant.

Based on the preceding results, our second hypothesis—that high-quality start-ups will generate larger overall employment effects than their lower-quality counterparts—is confirmed with respect to new firms in knowledge-intensive service industries but not for innovative manufacturing industries. The insignificance of the effect of start-ups in innovative manufacturing industries on overall employment is surprising and fails to meet our expectations. We can think of at least two explanations for this result. First, new businesses in innovative manufacturing industries are very rare as they make up only 2.8 percent of all start-ups. Hence, their effect on overall employment may be too small to be statistically significant. Second, by regressing regional start-ups on employment change in the same region, we cover only that part of the displacement and the supply-side effects that occur in the same region. This incomplete coverage of the indirect employment effects of new business formation may be relatively pronounced with regard to start-ups in innovative manufacturing industries since these new businesses tend to operate to a greater extent in interregional markets than do those in non-innovative industries. It is therefore plausible to assume that the

insignificant results for start-ups in innovative manufacturing do not indicate a lack of employment impact, but are caused by problems of empirical assessment.

5. Discussion

Recent empirical analyses indicate a strongly positive relationship between the magnitude of the employment effects of start-ups and their quality. Our investigation firmly confirms these findings with regard to the direct employment effect of start-ups, i.e., the employment in the new firms, and partly as to their impact on overall employment. Distinguishing between different sectors, we find that new businesses affiliated with manufacturing industries have a stronger direct and total employment effect than do start-ups in services. Within these two large economic sectors, the new businesses affiliated with innovative and knowledge-intensive industries make a relatively larger direct employment contribution than do their non-innovative and non-knowledge-intensive counterparts. Our argument that start-ups in innovative and in knowledge-intensive industries also cause comparatively larger total employment effects due to the relatively strong competitive pressure they exert on incumbents was confirmed only for new ventures in knowledge-intensive services. The insignificance of the effect of start-ups in innovative manufacturing on overall regional growth may be due to their relatively small number and/or because of estimation problems with regard to their displacement and supply-side effects. Nevertheless, our results show very clearly that not all start-ups are equally important for growth and that the quality of the new businesses as indicated by their affiliation with sectors and innovative and knowledge-intensive industries plays an important role.

One weakness of our analysis, and one it shares with most other empirical work in this field, has to do with identifying innovative and knowledge-intensive services based on industry affiliation. Industry affiliation is an imprecise criterion for identifying innovative start-ups because the respective industries encompass quite a number of non-

innovative firms and highly innovative start-ups can and regularly do occur in industries not classified as innovative. The reason this rough method is common practice in empirical analyses is that convincing alternatives are largely absent. We are also not aware of any comprehensive data set that allows for a better definition of innovative and knowledge-intensive start-ups in Germany or in other countries.

The empirical evidence clearly shows that it is only a relatively small share of all start-ups that is responsible for the main effect of entrepreneurship on growth. This suggests that a growth-oriented policy should focus on this type of start-up. Such a policy could be comprised of several strategies. For example, guard against any kind of market failure that will hamper innovative new businesses, such as an insufficient supply of venture capital or credit rationing. Second, stimulate the formation of more innovative start-ups. Third, provide after-entry support to innovative start-ups.

The first strategy is conceptually unproblematic and widely agreed upon; the main difficulty is choosing the most appropriate policy instruments for its implementation. The second strategy, supporting the formation of innovative start-ups, offers a wide range of policy options. These include, for example, measures such as basic education in natural sciences, access to tertiary education, provision of entrepreneurial education programs, and creating an entrepreneurial climate, as well as implementing institutions conducive to innovative start-ups (for a more detailed discussion of these issues, see Henrekson and Johansson, 2009). Since these instruments are indirect in nature and targeted at the pre-entry phase, they should pose no risk to the “survival of the fittest” scenario, which is a precondition for the emergence of positive supply-side effects of new business formation. Hence, introducing measures that are aimed at improving the quality of start-ups in the pre-entry phase is recommended.

The third strategy encompasses many of the types of support for new ventures that already exist. However, many of these supports *do* pose a

threat to the survival of the fittest scenario, and need to be assessed with that caution in mind. For example, they can result in deadweight losses as well as substitution effects (Santarelli and Vivarelli, 2002; Vivarelli, 2004). In the first case, new firms obtain public support (e.g., subsidies) even though they do not need them in order to survive and grow. In the latter case, subsidies keep less efficient start-ups in the market, in the absence of which competition would have forced their exit. Such distortion of the market selection process hampers the emergence of supply-side effects of new business formation that tend to be quantitatively much more important than their direct effect, i.e., the jobs created in the young firms (for details, see Fritsch and Noseleit, 2009a, 2009b). Hence, subsidizing firms after market entry, no matter their quality, is not only a waste of taxpayers' money but may also be harmful for growth. This strategy is not recommended.

Our results clearly suggest that not all start-ups are of equal importance for growth and that the quality of new businesses plays an important role in this respect. The relationship between the quality of new businesses and its effect on overall economic development is a largely unexplored field, holding interesting and promising possibilities for further research. In this paper, we focused on innovativeness and knowledge-intensity; future studies could investigate other aspects of quality, such as the qualification of the entrepreneur and the business concept, as well as the amount and quality of resources mobilized for the new business. A main bottleneck for such research is the measurement of quality. Further research should be devoted to the creation and validation of a more reliable and precise definition of innovativeness than that currently used, that is, industry affiliation.

Appendix

Table A1: Classification of innovative manufacturing industries and knowledge-intensive service industries

Innovative manufacturing industries

Manufacture of chemicals and chemical products
- Manufacture of basic chemicals
- Manufacture of other chemical products
- Manufacture of man-made fiber

Manufacture of machinery and equipment n.e.c.
- Manufacture of general purpose machinery
- Manufacture of special purpose machinery
- Manufacture of domestic appliances n.e.c.

Manufacture of office, accounting, and computing machinery

Manufacture of electrical machinery and apparatus n.e.c.
- Manufacture of electric motors, generators, and transformers
- Manufacture of electricity distribution and control apparatus
- Manufacture of insulated wire and cable
- Manufacture of accumulators, primary cells, and primary batteries
- Manufacture of electric lamps and lighting equipment
- Manufacture of other electrical equipment n.e.c.

Manufacture of radio, television, and communication equipment and apparatus
- Manufacture of electronic valves and tubes and other electronic components
- Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
- Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods

Manufacture of medical, precision, and optical instruments, watches and clocks
- Manufacture of medical appliances and instruments and appliances for measuring, checking, testing, navigating, and other purposes, except optical instruments
- Manufacture of optical instruments and photographic equipment

Manufacture of motor vehicles, trailers, and semi-trailers
- Manufacture of motor vehicles
- Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers

- Manufacture of parts and accessories for motor vehicles and their engines

Manufacture of other transport equipment

- Manufacture of railway and tramway locomotives and rolling stock
- Manufacture of aircraft and spacecraft

Knowledge-intensive services

Financial intermediation, except insurance and pension funding

Activities auxiliary to financial intermediation

Renting of transport equipment; renting of other machinery and equipment

Research and development activities

Real estate activities

Legal, accounting, book-keeping, and auditing activities; tax consultancy; market research and public opinion polling; business and management consultancy

Architectural, engineering, and other technical activities

Advertising

Source: Own classification according to Grupp and Legler (2000)

Table A2: Descriptive statistics

Variable	Mean	Median	Minimum	Maximum	Standard Deviation
Start-up rate (log)	2.104	2.112	1.501	2.763	0.232
Start-up rate in manufacturing (log)	0.133	0.133	-0.401	0.660	0.187
Start-up rate in services (log)	1.949	1.952	1.259	2.670	0.257
Start-up rate in innovative manufacturing industries(log)	-1.393	-1.384	-2.062	-0.747	0.232
Start-up rate in knowledge-intensive service industries (log)	0.014	0.007	-0.700	0.874	0.307
Share of highly-skilled employees	0.050	0.043	0.014	0.183	0.025
Population density	5.442	5.288	0.659	4.253	7.126
Market potential (log)	-3.452	-3.435	-4.122	-2.871	0.261
Employment change	-0.001	-0.011	-0.150	0.240	0.048

Table A3: Correlations between variables (Pearson correlation coefficients)

		1	2	3	4	5	6	7	8
1	Start-up rate all sectors (log)	1							
2	Start-up rate in manufacturing (log)	0.848	1						
3	Start-up rate in services (log)	0.934	0.776	1					
4	Start-up rate in innovative manufacturing industries (log)	0.441	0.641	0.375	1				
5	Start-up rate in knowledge-intensive services (log)	0.719	0.434	0.754	0.337	1			
6	Share of highly-skilled employees	0.198	0.058	0.045	0.147	0.56	1		
7	Population density (log)	-0.031	-0.190	0.006	-0.024	0.401	0.603	1	
8	Market potential (log)	-0.393	-0.534	-0.349	0.161	0.401	0.577	0.508	1
9	Employment change	0.187	0.075	0.105	0.169	0.325	0.233	0.076	0.253

References

Acs, Zoltan J. and Pamela Mueller (2008): Employment Effects of Business Dynamics: Mice, Gazelles and Elephants. *Small Business Economics*, 30, 85–100.

Arauzo-Carod, Joseph-Maria, Daniel Liviano-Solís, and Monica Martín-Bofarull (2008): New Business Formation and Employment Growth: Some Evidence for the Spanish Manufacturing Industry. *Small Business Economics*, 30, 73–84.

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

Audretsch, David B. and Michael Fritsch (2002): Growth Regimes Over Time and Space. *Regional Studies*, 36, 113–124.

Audretsch, David B., P. Houweling, and Roy Thurik (2000): Firm Survival in the Netherlands. *Review of Industrial Organization*, 16, 1–11.

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

Baptista, Rui, Victor Escária, and Paulo Madruga (2008): Entrepreneurship, Regional Development and Job Creation: The Case of Portugal. *Small Business Economics*, 30, 49–58.

Baptista, Rui and Miguel T. Preto (2011): New Firm Formation and Employment Growth. Regional and Business Dynamics. *Small Business Economics*, 36.

Engel, Dirk and Georg Metzger (2006): Direct Employment Effects of New Firms—Further Empirical Insights Concerning the Regional and Technological Dimension. In Michael Fritsch and Jürgen Schmude (eds.), *Entrepreneurship in the Region*, New York: Springer, 75–93.

Fritsch, Michael (2008): How Does New Business Formation Affect Regional Development? Introduction to the Special Issue. *Small Business Economics,* 30, 1–14.

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

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

Fritsch, Michael and Florian Noseleit (2009a): Investigating the Anatomy of the Employment Effects of New Business Formation. *Jena Economic Research Papers,* 001 – 2009, Friedrich Schiller University and Max Planck Institute of Economics Jena.

Fritsch, Michael and Florian Noseleit (2009b): Start-Ups, Long- and Short-Term Survivors and Their Effect on Regional Employment Growth.

Jena Economic Research Papers, 081 – 2009, Friedrich Schiller University and Max Planck Institute of Economics Jena.

Fritsch, Michael and Alexandra Schroeter (2009): Are More Start-Ups Really Better? Quantity and Quality of New Businesses and Their Effect on Regional Development. *Jena Economic Research Papers*, 070 – 2009, Friedrich Schiller University and Max Planck Institute of Economics Jena.

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

Glaeser, Edward L., Hedi Kallal, Jose A. Scheinkman, and Adrei Shleifer (1992): Growth of Cities. *Journal of Political Economy*, 100, 1126–1152.

Grupp, Hariolf and Harald Legler (2000): Hochtechnologie 2000: Neudefinition der Hochtechnologie für die Berichterstattung zur technologischen Leistungsfähigkeit Deutschlands, Karlsruhe und Hannover: FhG-ISI und NIW.

Henrekson, Magnus and Dan Johansson (2009): Competencies and Institutions Fostering High-Growth Firms. *Foundations and Trends in Entrepreneurship*, 5, 1–80.

Kronthaler, Franz (2005): Economic Capability of East German Regions: Results of a Cluster Analysis. *Regional Studies*, 39, 739–750.

Licht, Georg and Eric Nerlinger (1998): New Technology-Based Firms in Germany: A Survey of the Recent Evidence. *Research Policy*, 26, 1005–1022.

Lucas, Robert (1988): On the Mechanics of Economic Development. *Journal of Monetary Economics,* 22, 3–42.

Metzger, Georg and Christian Rammer (2009): Unternehmensdynamik in forschungs- und wissensintensiven Wirtschaftszweigen in Deutschland, *Studien zum deutschen Innovationssystem 05-2009*, Berlin: ZEW.

Mueller, Pamela, Andre J. van Stel, and David J. Storey (2008): The Effects of New Firm Formation on Regional Development Over Time: The Case of Great Britain. *Small Business Economics*, 30, 59–71.

Peneder, Michael (2002): Industrial Structure and Aggregate Growth. *Structural Change and Economic Dynamics,* 14(4), 427–448.

Peneder, Michael, Serguei Kaniovsky, and Bernhard Dachs (2003): What Follows Tertiarisation? Structural Change and the Role of Knowledge-Based Services. *Service Industry Journal*, *23*, 47–66.

Redding, Stephen and Daniel Sturm (2008): The Costs of Remoteness: Evidence from German Division and Reunification. *American Economic Review,* 98*,* 1766–1797.

Santarelli, Enrico and Marco Vivarelli (2002): Is Subsidizing Entry an Optimal Policy? *Industrial and Corporate Change*, 11, 39–52.

Schettkat, Ronald (2007): The Astonishing Regularity of Service Employment Expansion. *Metroeconomica*, 58, 413–435.

Schindele, Yvonne and Antje Weyh (2011): The Direct Employment Effects of New Businesses in Germany Revisited—An Empirical Investigation for 1976–2004. *Small Business Economics*, 36.

Spengler, Anja (2008): The Establishment History Panel, S*chmollers Jahrbuch/Journal of Applied Social Science Studies,* 128, 501–509.

Südekum, Jens (2008): Convergence of the Skill Composition Across German Regions. *Regional Science and Urban Economics*, 38, 148–159.

Van Stel, Andre and Kashifa Suddle (2008): The Impact of New Firm Formation on Regional Development in the Netherlands. *Small Business Economics*, 30, 31–47.

Vivarelli, Marco (2004): Are All the Potential Entrepreneurs So Good? *Small Business Economics,* 23, 41–49.