ENTREPRENEURSHIP IN THE REGION

Michael Fritsch and Jürgen Schmude

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FOREWORD

The articles collected in this book are based on projects that have been financially supported by the *German Science Foundation* (DFG) in the framework of the priority program "Interdisciplinary Entrepreneurship Research" in the years from 1998 to 2004 Although not all of the projects had initially planned to focus on regions, the various discussions of the research results in the different phases of the priority program clearly showed that regional factors did indeed play an important role. This gave rise to the idea of organizing this collection of articles based on the priority program that in one way or another deal with the regional dimension in entrepreneurship.

This book would not have been possible without the vital support of a number of persons and institutions. We are particularly indebted to the German Science Foundation for the funding of the priority program. Rachelle R. Rinke was of invaluable help in the editing of the English language in the articles written by non-native speakers. Sandra Mueller did a great job in carefully preparing the camera-ready manuscript. Last but not least, the authors deserve gratitude for their work. We hope that this book will provide inspiration for further research in the field of entrepreneurship, particularly the investigations of regional factors that effect entrepreneurship and its impact on development.

Freiberg and Regensburg, August 2005

Michael Fritsch
Jürgen Schmude

1 INTRODUCTION AND OVERVIEW

Michael Fritsch and Juergen Schmude

1. Entrepreneurship in the Region

Entrepreneurship has a pronounced regional dimension. Differences in start-up rates, in entrepreneurial attitudes, and the success of newly founded businesses between regions indicate a distinct importance of space and the local environment for entrepreneurship. Empirical research has shown that such differences are not at all elusive but tend to be rather persistent and to prevail over longer periods of time.

Dealing with different aspects of entrepreneurship, the articles collected in this book all approach their topic from a spatial perspective. The various regional influences on entrepreneurship analyzed entail regional peculiarities and disparities in new business formation processes, employment effects of new firms, the importance of social capital and of network structures, as well as entrepreneurship education and training provided in the regions. The contributions to this book clearly show that there is a diversified set of approaches on how to relate entrepreneurship and new firm formation processes to regions. Differences between approaches include the understanding of what is the appropriate regional level of analysis. While most of the articles utilize the highly disaggregated level of the German districts ("Kreise"), others address larger regional entities like planning regions ("Raumordnungsregionen"), the federal states ("Länder"), or analyze the differences between the eastern and the western part of the country, whose divergent historical backgrounds are still imprinted in their socioeconomic development. The articles in this book also follow different research strategies for investigating the regional context of entrepreneurship and new business formation. While some analyze the influence of regional factors by in-depth case studies of certain regions, which are often based on data that have been raised by postal questionnaires and through personal interviews, others are conducting interregional comparisons that include all regions of the country. Such differences in the types of approaches not only depend on the particular question under investigation but also reflect the research traditions of the disciplines involved. The contributions of the different academic disciplines clearly demonstrate that their research methods are complementary in character. Entrepreneurship

research is an interdisciplinary issue that benefits from the contribution of various ways of approaching the issue.

All articles in this book are based on the priority research program "Interdisciplinary Entrepreneurship Research" that the German Science Foundation (DFG) has granted in the 1998-2004 period. The research reported here has been conducted in the final phase of the program between the years 2002 and 2004.

2. Entrepreneurial Regions, Employment Effects, and Innovation in Regional Systems – An Overview

The articles in this book cover three major issues. The first set of questions concerns the effect of regional characteristics on the entrepreneurial attitudes, behavior, and activities of the inhabitant population. What makes a region "entrepreneurial," and how could policy stimulate regional entrepreneurship? Such questions are examined for the regional population as a whole (chapter 2), for particular subgroups such as (potential) women entrepreneurs (chapter 3) and for students at universities (chapter 12). The second domain of the book addresses the employment effects of newly established businesses in quantity as well as the quality of the jobs generated by the start-ups (chapters 4, 5, 6, and 7). A third group of papers puts emphasis on the development of selected innovative industries within particular regional economic systems (chapters 8, 9, and 10).

Subsequent to the introductory chapter, Ingo Lückgen, Dirk Oberschachtsiek, Rolf Sternberg, and Joachim Wagner report empirical evidence from the Regional Entrepreneurship Monitor (REM), a research project that is related to the Global Entrepreneurship Monitor (GEM) focusing on ten German regions. Their results are derived from comparing the shares of nascent entrepreneurs from 2003 to those from 2001 in the regions under investigation (chapter 2). In the contribution by Friederike Welter and Lutz Trettin they investigate the spatial embeddedness of supporting networks for and of women entrepreneurs, with a particular emphasis on the emergence of the institutional formal network structure in two regional settings (chapter 3). While the authors observe a "bottom-up"-approach for the network evolution in the State of Mecklenburg-Western Pomerania – where women entrepreneurs have been the main driving force for network creation – a more "top-down"-mechanism is identified for the Munich region.

The subsequent contributions (chapters 4, 5, 6, and 7) deal with the employment effects of new businesses. On the basis of the Establishment register derived from the German Social Insurance Statistics, Antje Weyh examines survival and the development of employment in start-up cohorts in different regions and industries of West Germany. She analyzes the characteristics of start-up cohorts that created a relatively large number of jobs as well as the

factors which influence the success of these cohorts (chapter 4). One result is that new manufacturing firms have the best survival chances in rural areas whereas start-ups in the service sector show higher employment development in agglomeration areas. High regional start-up rates have, however, a negative effect on new firm survival indicating a high intensity of competition and market selection in these regions. Dirk Engel and Georg Metzger also analyze medium term employment effects of start-up cohorts drawn from the ZEW Foundation Panels (chapter 5). Their results suggest a comparatively good performance of firms set up by founders with an academic degree as well as of firms in high-technology sectors. Building on data provided by the same source, Michaela Niefert investigates differences in entry patterns and post-entry performance between Eastern and Western Germany firms as well as between patenting and non-patenting firms (chapter 6). She finds that in the time since the unification, Eastern German start-ups have been comparatively larger, have grown faster, and have relied on more seed capital and financial support than those in West Germany. Generally, involvement in patenting activities enhances the employment growth performance of newly founded firms.

Udo Brixy, Susanne Kohaut, and Claus Schnabel investigate wage setting and labor fluctuation in newly founded and in established firms with a linked employer-employee data set generated from the German Social Insurance Statistics (chapter 7). The authors show that start-ups are characterized by higher labor fluctuation, lower bargaining coverage, and lower wages than incumbent establishment. Their results, however, indicate that such differences disappear rather rapidly as new firms mature.

Chapters 8 to 10 focus on specific economic sectors such as knowledge-intensive services or the surgical instruments industry within particular regions. Ralf Binder and Björn Sautter investigate the effects of the regional environment on new firm formation and survival in the surgical instrument cluster of Tuttlingen, which is one of the most important locations of the industry world-wide (chapter 8). A particular emphasis of their analysis is on the importance of social ties within this cluster. They show that the relationships between the members of the cluster are often characterized by considerable mistrust towards actors outside as well as within the cluster. According to their analysis, social ties and personal trust between actors play a decisive role for getting access to critical resources. Knut Koschatzky and Thomas Stahlecker investigate structural ties of young firms of the knowledge-intensive business (KIBS) sector in the regional innovation system of the city of Bremen (chapter 9). A focus of the empirical analysis is the role of these firms for the transfer of knowledge and technology. They conclude that in the innovation system of Bremen, KIBS play a significant role for the modernization and development. In particular, they have an important function as being a bridge between the sector of public education and research (universities, public research institutions), on the one side, and the commercial application

of new knowledge, on the other side. Andreas Koch and Harald Strotmann in their contribution analyze determinants of innovation activity based on data from three German agglomerations (chapter 10). They find that the managerial characteristics of the firm founders as well as interaction between firms in networks are crucial for innovative behavior.

The contribution by Michael Fritsch and Pamela Mueller gives an overview of their research on the employment effects of new business formation, the evolution of regional entrepreneurship, and the transition of regional growth regimes (chapter 11). They emphasize the importance of indirect employment effects of new business formation. Analyzing the level of new business formation over a longer period of time, they find that the changes are rather small. This suggests that a policy that intends to stimulate start-ups can only be effective in the longer run. An analysis of typical patterns of start-up activity and regional development confirms this need of a long-run orientation of entrepreneurship policies.

Finally, Kerstin Wagner, Frank Bau, Juergen Schmude, and Michael Dowling investigate regional differences of entrepreneurship education in universities focusing on three regions (chapter 12). They particularly focus on the effects of regional structures on students' entrepreneurial attitudes. Surprisingly, those attitudes are hardly at all likely to depend on such regional structures. Rather they may be considerably determined by the type of faculty at which the courses of entrepreneurship education are located as well as by the size of the university.

3. Outlook

The articles in this book provide strong evidence for the importance of regional factors for entrepreneurship and new firm formation processes. They also demonstrate that a plurality of approaches in the analysis of entrepreneurship can be very fruitful. Entrepreneurship is a rather complex phenomenon, and there is no single appropriate way of analyzing the issue. The emergence and the success of a new firm should be explained and understood as a multi-dimensional product of numerous factors. For example, the success of a newly founded firm does not only depend on the abilities and resources of the founder but also on the availability of funds, on public policy, on technological development, on the industrial context and, of course, on regional parameters such as infrastructure, the regional workforce, local networks of customers and suppliers, spatial proximity to research institutes, the intensity of knowledge spillovers, and support by the public administration. Therefore, a variety of approaches, particularly the involvement of different disciplines, is needed in order to arrive at a proper understanding of entrepreneurship and new firm development. Further research programs should account for this need for a plurality of approaches. To organize a fruitful cooperation of dif-

ferent approaches and academic disciplines may be regarded a main challenge for future research on entrepreneurship.

Apart from this need for variety, the articles collected in this book clearly suggest that further research on entrepreneurship as well as entrepreneurship policy should account for the regional dimension. Space and location do matter a lot for entrepreneurship. Therefore, entrepreneurship policies of a "one size fits all"-type, i.e. operating with uniform measures that are performed nearly the same way all over the country may not be appropriate. This leads to the question of appropriate ways to regionalize entrepreneurship policies. One way of accounting for region-specific factors in national entrepreneurship policies could be to involve regional actors in the design, administration, and financing of the programs. Because nearly all new businesses are set up at a location close to the place where the founder lives, stimulating entrepreneurship could be an important element of a policy that tries to promote the endogenous growth potential of regions. How this could be effectively done is another question for further research.

2 NASCENT ENTREPRENEURS IN GERMAN REGIONS

Evidence from the Regional Entrepreneurship Monitor (REM)

Ingo Lückgen, Dirk Oberschachtsiek, Rolf Sternberg and Joachim Wagner

1. Introduction

Nascent entrepreneurs are people who are (alone or with others) actively engaged in creating a new venture, and who expect to be the owner or part owner of this start-up. Recently, an increasing number of empirical studies deals with the impacts of start-up activities on economic development of nations (Wong, Ho and Autio forthcoming; van Stel, Carree and Thurik forthcoming) and subnational regions (Acs and Armington, 2004; Fritsch and Mueller, 2004). Obviously different types of entrepreneurial activities may have different impacts on economic growth. Especially high growth potential entrepreneurship is found to have a significant (positive) impact on the dependent variables of economic growth in economically advanced countries. Given that newly founded firms are important for the economic development of nations and regions, and that nascent entrepreneurs are by definition important for the foundation of new firms, information about nascent entrepreneurs is important for understanding crucial aspects of the economy. This information, however, can not be found in publications from official statistics. Until the turn of the millennium, therefore, we knew next to nothing about nascent entrepreneurs in Germany. The situation improved considerably when results from the first German wave of the *Global Entrepreneurship Monitor (GEM)* survey became available in 1999.[1] The GEM project, however, is focused on

1 In the long-term "Global Entrepreneurship Monitor (GEM)" research project, which was created in 1998 (pilot phase, first data available for 1999), an international team of researchers (see www.gemconsortium.org for details and all country reports and global reports) documents and analyses the scope and causes of entrepreneurial activities and the complex relationship between entrepreneurship and economic growth in various countries and publishes the results each year (global reports and country reports). GEM started with ten participant countries; 31 countries were involved in the most recent study for 2003. Germany is one of the six countries which have been involved in the GEM project from the very beginning. The German country team is led by the third author. The results of recent years have shown that entrepreneurial ac-

variations of entrepreneurial activity between entire countries. The relevance of detailed information on nascent entrepreneurs at the *regional* level, and the lack of it for Germany, led us to start the research project *Regional Entrepreneurship Monitor (REM) Germany* in 2000. As part of this project, we performed a representative survey of the adult population in ten German regions, plus a survey and interviews with local experts in the field of entrepreneurship. A second wave followed in 2003. This paper summarizes our findings using data from these surveys and interviews.

The rest of the paper is organized as follows: Section 2 reports the shares of nascent entrepreneurs in the adult population in ten German regions in 2001 and 2003, and presents some descriptive explanations on the reasons for regional variation based upon entrepreneurial framework conditions. In section 3 we deal with the question whether nascent entrepreneurs are different from the rest of the adult population, and whether there is a typical nascent entrepreneur with a typical set of characteristics. Here we describe the relationship between the prevalence rate of nascent entrepreneurs and selected personal characteristics. The following two sections summarize findings from our econometric investigations using the REM data: In section 4 we look at studies which focus on the ceteris paribus effect of personal characteristics (like being male, or coming from a family with at least one self-employed family member) and of regional characteristics (like density of population, or price of land) on the propensity to become a nascent entrepreneur. Section 5 reviews findings from econometric studies which deal with selected special topics in nascent entrepreneurship: The role of gender and gender-specific differences in risk aversion; the professional background and Lazear's Jack-of-all-trades – theory; the employment status of nascent entrepreneurs and differences among the unemployed, the employed and those out of the labor force; the role of failure as a self-employed in the past and the taking a second chance; and characteristics of the (former) workplace and the role of small, young firms as 'hothouses' for nascent entrepreneurs. Section 6 concludes by putting our findings into perspective and identifying open questions for future research.

2. Nascent Entrepreneurship in Ten German Regions: the Evidence

The data used in this paper are taken from the research project Regional Entrepreneurship Monitor (REM) (Bergmann, Japsen and Tamásy, 2002; Lückgen and Oberschachtsiek, 2004). REM focuses on the extent of the difference

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tivities within a country are in statistical relationship with overall economic development and that interregional differences in entrepreneurial activities and attitudes are obvious (for further information on the GEM country reports Germany see http://www.wiso.uni-koeln.de/wigeo/, see also Sternberg and Lückgen, 2005). For the most recent global report of GEM see Acs et al. (2005).

in entrepreneurial activities between regions in Germany, its determinants and consequences for regional development. The concept of the Regional Entrepreneurship Monitor is similar to that of the Global Entrepreneurship Monitor (GEM), a multi-country study that investigates the same topics at a national level (see footnote 1).

Data collection was carried out in ten out of ninety-seven so-called planning regions or "Raumordnungsregionen" (Bundesamt für Bauwesen und Raumordnung, 2001). Even if we cannot claim that the data is representative for Germany as a whole, the regions were selected in such a way that they mirror the spatial structure with regard to old and new federal states (i.e. West and East Germany), highly industrialized versus more rural regions, center and periphery etc. Information relating to the average in the selected regions can be considered to be a valid instrument for information on Germany as a whole. The regions included in the REM project are Cologne, Munich, Lueneburg, Middle Schleswig Holstein, Main-Rhoen, Stuttgart, Middle Hesse, Western Saxony/Leipzig, Emscher-Lippe and Middle Mecklenburg/Rostock (for detailed information regarding the selection of the regions see Lückgen and Oberschachtsiek, 2004).

Data were collected in telephone surveys of the adult population, in mail surveys of local entrepreneurship experts, and in face-to-face interviews with selected experts in the regions. The two REM telephone surveys of the German population aged 18-64 were conducted using computer assisted telephone interviewing in the summer of 2001 and 2003. In each of the ten regions a random sample of 1000 people were interviewed, leading to a data set with 20,000 cases. The random sampling process ensures that the sample is representative of the population in the respective region. For further details on each of the REM surveys, see the specific reports on the methodology of this research project (Lückgen and Oberschachtsiek, 2005; Japsen, 2002).

The mail survey of regional experts was carried out in each of the ten regions to investigate the impact of entrepreneurial framework conditions (EFCs) on regional entrepreneurial activities. These framework conditions cover fields that affect entrepreneurial activities such as finance, physical infrastructure, government policy, government programs, technology transfer, entrepreneurial education, labor market, cultural and social norms, networks and female entrepreneurship (for details see Lückgen and Oberschachtsiek, 2004).

In the population survey the interviewees were asked whether they, alone or with others, were actively involved in starting a new business that will, as a whole or in part, belong to them. It was also asked whether this business did not pay full wages or salaries for more than three months to anybody, including the interviewee. Those who answered in the affirmative are considered to be *nascent entrepreneurs*.

According to the population surveys, the share of nascent entrepreneurs among adults aged 18 to 64 years in 2003 was 4.4 percent, and it was

0.8 percentage points higher than in 2001. Figure 2.1 reports detailed results for the ten regions in both years. Interregional differences in the order of magnitude point to differences in the level of entrepreneurial activity among the regions. The share of nascent entrepreneurs in 2003 is about twice as high in the regions of Cologne, Western Saxony/Leipzig and Munich, as in the regions of Emscher-Lippe and Middle Mecklenburg/Rostock. The largest changes between 2001 and 2003 took place in the regions of Western Saxony/Leipzig, Middle Hessen, Munich and Stuttgart. In these regions, the share of nascent entrepreneurs increased remarkably, e. g. in Western Saxony/Leipzig from 2.8 percent to 5.7 percent.

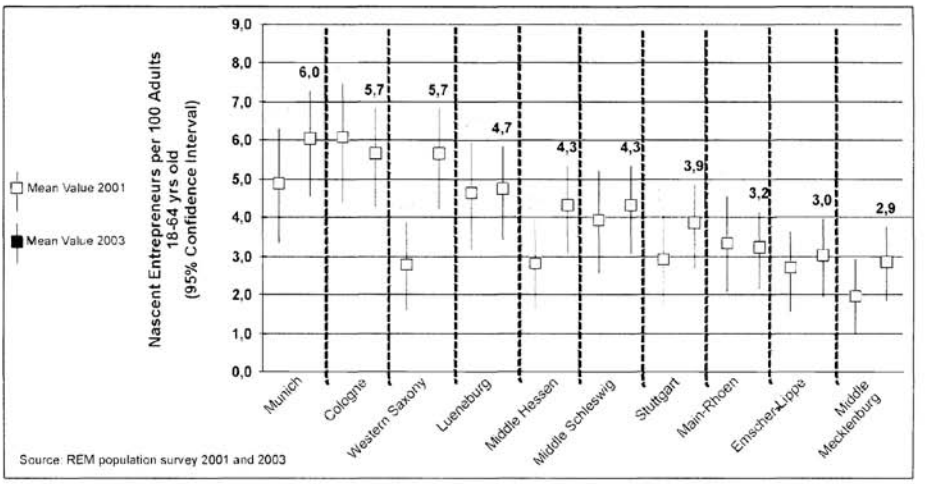

Figure 2.1: Share of nascent entrepreneurs in the ten investigated regions in summer 2001 and 2003

Why does the level of entrepreneurial activity differ between the ten regions? The REM project looks at two parameters influencing entrepreneurial activity: entrepreneurial attitudes and entrepreneurial framework conditions. Analyses for 2001 and 2003 show that on average, people from regions with a high share of nascent entrepreneurs (e. g., Munich and Cologne) state that they have the skills necessary to found a new business more often, they are less risk averse, and they see better chances for a successful start of a business more often than interviewees from regions with lower shares of nascent entrepreneurs (e. g., Emscher-Lippe and Mecklenburg/Rostock). These results illustrate that there is a strong relationship between entrepreneurial attitudes in a region and the regional level of entrepreneurial activity. Compared to entrepreneurial Attitudes, the EFCs – information which has been gathered in the mail surveys of the local entrepreneurship experts – have much less impact on the level of entrepreneurship activity in the regions (for details see Bergmann, Japsen and Támasy, 2002, and Lückgen and Oberschachtsiek, 2004).

3. Who is a Nascent Entrepreneur?

Definition of nascent entrepreneurs within REM is in line with the one used in GEM (see Reynolds et al. forthcoming), although, other definitions do exist as well. This section looks at the socio-demographic structure of nascent entrepreneurs. Here we discuss the question whether nascent entrepreneurs are different compared to the adult population as a whole. To do so we compare means and percentages for selected socio-demographic items. Given that we have information from two points of time, we furthermore discuss the variation of these items over time for those variables that were measured identically in both surveys.

The evidence is reported in table 2.1. Note that the number of nascent entrepreneurs is small compared to the size of the sample as a whole. To take this into account we do not only report means and percentages for the items under investigation; the bounds of the 95 percent confidence intervals are displayed, too.[2]

Socio-demographic characteristics are captured by sex, age, martial status, education, employment status, household size and the net household income. Results are displayed for nascent entrepreneurs and the adult population. If possible, these figures are reported for 2001 and 2003.

To analyze the socio-demographic structure, the percentages reported for nascent entrepreneurs and for the adult population are compared. If there is no overlap of the confidence interval – displayed in brackets – the difference between the shares of the two groups is statistically significant at an error level of five percent. To look at variation over time, focus on the percentages reported for either nascent entrepreneurs or the adult population in different years.

To start, we will focus on two basic socio-demographic characteristics, sex and age. First, concerning the adult population every second person is female. The share of females in the group of nascent entrepreneurs is statistically significantly lower in both years -31.5 percent and 36.7% in 2001 and 2003, respectively. This supports the theses that females are less likely to start a new business. While the share of females among nascent entrepreneurs increased between 2001 and 2003, the difference between the two years is not statistically significant. Second, while the adults are on average about 41.5 years old, the average nascent entrepreneur is younger (38.5 years in 2001, 37.5 years in 2003). A look at the confidence intervals reveals that these differences in age are statistically significant at a conventional level.

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2 The main target population interviewed in both years covers people aged between 18 and 64. However, in 2001 we interviewed people who were younger and older, too. Thus, all interviewees who are not aged between 18 and 64 were dropped. This lead to a smaller sample size in 2001 compared to the 2003 sample.

Next we look at the marital status. We asked the interviewee if he or she is not married, married or divorced. Nascent entrepreneurs are more often single (not married) and less often divorced compared to the adult population. This difference, however, is statistically significant for the category "not married" only. Compared to the share in nascent entrepreneurs, the share of unmarried people in the adult population is some eight percentage points lower in both years.

Third, we consider education. Note here that the items asked in the interview in 2001 and 2003 are different. In 2001, we asked for the highest exam passed only, while in 2003 the interviewee was asked to report every exam he or she passed. Statistically significant differences are found for three items: extended elementary school (Hauptschule), senior high school (A-level; German: Hochschulreife) and university (Hochschulabschluss). Nascent entrepreneurs are on average better educated than the adult population as a whole. For example, while the share of people in the adult population who finished extended elementary school is 28.6 percent this share is 22.2 percent only in the group of nascent entrepreneurs. Furthermore, while 53.3 percent of the nascent entrepreneurs hold an A-level, this share is much lower (41.5 percent) for the adult population as a whole. More than 46 percent of the nascent entrepreneurs hold a university diploma – almost 15 percentage points more than in the adult population as a whole.

Next, we look at the employment status of the individuals. Compared to the adult population as a whole, nascent entrepreneurs are more often unemployed and less likely to be a housewife (or retired). While we observe a statistically significant and large difference in the share of people working full-time between nascent entrepreneurs and the adult population in 2001, this difference disappears in 2003. On the other hand, the share of both part-time workers and unemployed among the nascent entrepreneurs increased between 2001 and 2003. This indicates that part-time workers and the unemployed became a more important source of entrepreneurship (self-employment) recently.

Last, we look at household size and net household income. To start with, the household size shows only small differences which are, in most terms, not statistically significant, too. In regards to net household income, the share of nascent entrepreneurs in the highest income class is higher compared to the adult population as a whole. Nascent entrepreneurs, therefore, tend to have a better financial background on average.

Table 2.1: The socio-demographic structure of nascent entrepreneurs and the adult population

	Nascent entrepreneur		Adult population	
Year	2001	2003	2001	2003
Sex				
Female	0.315 [0.259 0.370]	0.367 [0.321 0. 412]	0.494 [0.483 0.505]	0.496 [0.486 0.505]
Age	0.385 [0.371 0.399]	0.379 [0.369 0.389]	0.417 [0.415 0.421]	0.415 [0.412 0.417]
Marital status				
Unmarried	0.414 [0.356 0.474]	0.425 [0.378 0.472]	0.335 [0.325 0.346]	0.341 [0.331 0.350]
Married	0.454 [0.395 0.514]	0.483 [0.436 0.531]	0.534 [0.523 0.545]	0.539 [0.529 0.549]
Divorced	0.131 [0.090 0.171]	0.091 [0.064 0.118]	0.130 [0.122 0.137]	0.119 [0.113 0.125]
Education				
No exam		0.004 [-0.002 0.010]		0.006 [0.004 0.008]
Extended elementary school (Hauptschule)		0.222 [0.182 0.261]		0.286 [0.277 0.295]
Junior high school (Realschule, Mittlere Reife)		0.416 [0.370 0.462]		0.403 [0.394 0.413]
Senior high school (Abitur, Fachabitur)		0.533 [0.486 0.580]		0.415 [0.406 0.425]
dual training (Lehre, Berufsausbildung)		0.543 [0.496 0.590]		0.598 [0.589 0.608]
Master		0.086 [0.060 0.113]		0.069 [0.064 0.074]
University		0.461 [0.414 0.508]		0.313 [0.304 0.323]
Employment				
full-time working	0.660 [0.603 0.716]	0.554 [0.508 0.601]	0.518 [0.507 0.530]	0.526 [0.516 0.536]
part-time working	0.108 [0.071 0.145]	0.146 [0.112 0.179]	0.141 [0.134 0.149]	0.152 [0.145 0.159]
pupil, student	0.104 [0.067 0.140]	0.083 [0.057 0.109]	0.087 [0.081 0.094]	0.089 [0.084 0.095]

Continuation table 2.1:

	Nascent entrepreneur		Adult population	
Year	2001	2003	2001	2003
Housewife, retired	0.060 [0.031 0.088]	0.069 [0.045 0.093]	0.189 [0.180 0.198]	0.156 [0.149 0.163]
Unemployed	0.043 [0.019 0.067]	0.111 [0.082 0.141]	0.042 [0.038 0.047]	0.057 [0.052 0.061]
Civilian or military service	0.001 [-0.003 0.005]	0.012 [0.002 0.022]	0.005 [0.004 0.007]	0.003 [0.002 0.005]
out of the labor force	0.024 [0.006 0.042	0.021 [0.007 0.034]	0.012 [0.009 0.014]	0.012 [0.009 0.014]
Household size				
one person	0.239 [0.188 0.289]	0.231 [0.191 0.270]	0.208 [0.199 0.217]	0.200 [0.192 0.208]
two persons	0.289 [0.235 0.344]	0.306 [0.263 0.349]	0.208 [0.199 0.217]	0.306 [0.297 0.315]
more than two persons	0.466 [0.406 0.526]	0.463 [0.416 0.509]	0.450 [0.448 0.471]	0.493 [0.484 0.503
Net household income				
< 1500 Euro	0.213 [0.164 0.262]	0.179 [0.143 0.215]	0.223 [0.213 0.232]	0.187 [0.179 0.195]
>= 1500 Euro & <= 3000 €	0.342 [0.285 0.398]	0.406 [0.360 0.452]	0.413 [0.402 0.424]	0.391 [0.382 0.401]
>= 3000 Euro	0.327 [0.271 0.384]	0.350 [0.305 0.395]	0.205 [0.196 0.215]	0.296 [0.287 0.305]
Number of cases	272	437	7704	10000

This evidence from the two waves of the *Regional Entrepreneurship Monitor (REM) Germany* shows that certain types of individuals are more likely to be involved in creating a new venture, but that individuals from all categories are involved to some extent. The evidence considered so far is, however, only descriptive in nature, and it does not reveal the extent to which the various factors are interrelated. To give just one example, take the relationship between gender and nascent entrepreneurship on the one hand, and between labor force status and nascent entrepreneurship on the other hand. Men are more often involved in creating new ventures than women, and so are people who are working full time compared to those who are not in the labor force. Given that the share of men who are in paid full-time employment is much higher than the share of women, what is the ceteris paribus effect of being male, and of working full time, on the propensity of being a nascent entrepreneur? Descriptive bivariate comparisons can not reveal this. Multivariate analyses that tackle this topic are reviewed in the next section.

4. What Makes a Nascent Eentrepreneur? The Role of Personal and Regional Characteristics

4.1 The Choice Between Paid Employment and Self-Employment from an Individual's Perspective – Some Theoretical Thoughts

In section 4 we look at studies which focus on the ceteris paribus effect of personal characteristics (like being male, or coming from a family with at least one self-employed) on the one hand and regional characteristics (like density of population, or price of land) on the other hand on the propensity to become a nascent entrepreneur.[3] While values for the first group of variables stem from survey data collected during the REM I phase in 2001, values for the second group refers to publicly available data from secondary statistics (mainly from Bundesamt für Bauwesen und Raumordnung (BBR), 2001).

Empirical investigations of the ceteris paribus impact of individual and other characteristics and attitudes on the propensity to become a nascent entrepreneur are usually – either explicitly or implicitly – based on a theoretical framework that can be outlined as follows:

Consider a utility-maximizing individual that has the choice between paid employment and self-employment (taking the decision to participate in the labor market as given). This person will choose the option self-employment if the discounted expected life-time utility from self-employment ($DELU^s$) is higher than that from paid employment (DELUp). The difference Ni between $DELU^s_i$ and $DELU^p_i$,

(1) $N_i = DELU^s_i - DELU^p_i$.

Therefore, it is crucial for the decision of individual i, and he or she will choose self-employment if Ni is positive. DELUsi and DELUpi are determined by the expected monetary and non-monetary returns from self-employment and paid employment according to the utility function of the person and the individual's discount rate. Higher returns lead to higher values of DELU.

The expected monetary and non-monetary returns from both types of employment depend on variables related to individual i, summarized in the vector xi, and on variables related to the region j he lives in, collected in the vector y_j. The regional variables (i. e. the elements of y_j) include factors that are directly or indirectly influenced by future, current or past regional policy measures (like tax rates, quality of infrastructure, or the age structure of the population), and variables that are independent from regional policy (like natural climate or natural resources). Given that Ni depends on $DELU^s_i$ and

3 This section is based on parts of a previous publication by two of the authors (see Wagner and Sternberg, 2004).

$DELU^p_i$, and $DELU^s_i$ and $DELU^p_i$ depend on the monetary and non-monetary returns, N_i can be written as a function of x_i and y_j:

(2) $N_i = N_i (x_i, y_j)$.

Note that we assume here that a person chooses between paid employment and self-employment in the region he lives in.[4] A rational individual will consider each region j (j = 1, ..., k) and, given his individual characteristics and attitudes, compute $DELU^s_i$ and $DELU^p_i$ for all k regions (taking the costs of moving to a region into account) to choose the region with the maximum among these 2k values. Given high monetary and non-monetary costs of migration this often (but not always) means that a person will stay in the region he lives in – an empirically well-proved assumption for German entrepreneurs (see Sternberg et al., 1997).

Individual characteristics and attitudes (elements of x_i), and characteristics of the region (elements of y_j) including variables influenced by regional policy measures, which have a more positive or less negative impact on $DELU^s_i$ than on $DELU^p_i$ increase N_i (and vice versa). Given that the expected monetary and non-monetary returns from both types of employment, the utility function, and the discount rate of an individual are unknown to an observer, we cannot observe N_i. Therefore, we cannot test directly whether an individual or regional characteristic - say, age of a person, regional tax rates, or population density in a region - has a positive impact on N_i, or not. If, however, N_i is greater than the critical value zero, according to our theoretical framework, a person will choose to become an entrepreneur, and the decision to do so or not is observable. In our empirical model we will investigate the influence of x_i and y_j on the probability that a person becomes an entrepreneur by looking at his known decision pro or contra.

The theoretical hypotheses regarding a positive or negative influence of personal characteristics and attitudes, and of characteristics of the region, on this decision are discussed below in sections 4.2 and 4.3 together with a description of the way the elements of x_i and y_j are measured. Due to a lack of space, an extra table stating the analyzed determinants and the predicted sign of impact are not included here. Then the empirical results of our econometric study are presented.

4 Note that by focusing on the factors affecting the decision to become self-employed, as opposed to remaining in paid-employment, instead of looking at differences in the probability that people are self-employed rather than employees, one avoids confounding entry and survival effects: The probability of being self- employed at a point in time depends on the probability of switching into self-employment in the past and then surviving as a self-employed until the time of the survey (see Parker, 2004, 25-26).

4.2 An Empirical Model of the Determinants of Entrepreneurial Activities

In the theoretical model developed in section 4.1, the decision taken by person i to become a nascent entrepreneur or not is shaped by his personal characteristics and attitudes (collected in the vector x_i), and by characteristics of the region j he or she chose to live in (collected in vector y_j). In our empirical model we regress the observed decision of all persons from the REM survey aged between 18 and 68 on x and y. Selection of the elements included in x and y are, at least in part, data driven. Although we had full control over the design of the questionnaire used in the REM survey, we were unable to collect information on all individual characteristics that are important for the decision under consideration due to budget constraints (that limited the time per interview and the number of items to be included) and the willingness of the interviewees to report information on issues like the amount of personal wealth, or losses in bankruptcies in the past. Effects of variables not included in the empirical model are covered by the error term. Frankly, this might lead to an omitted variables bias – a problem common to many (all?) econometric investigations.

With that said, we will now turn to a discussion of the variables measured at the individual and at the regional level that are included in our empirical model. To start with the individual characteristics and attitudes, x_i has the following elements:

- *Sex* (a dummy variable taking the value one if the interviewee is male). Hypothesis: It is a stylized fact that men do have a higher propensity to step into self-employment than women, in Germany as in all other GEM countries (see Acs et al., 2004). Sex is included in our empirical model to control for this difference in behavior between men and women, and we expect a positive sign for the estimated coefficient of the dummy variable.
- *Age* (measured in years). Hypothesis: On the one hand, age is a proxy variable for personal wealth – the older a person is, the longer the potential period to accumulate wealth is. Given that young firms are often constrained by lack of credit because banks usually demand collateral to finance investments, a certain amount of wealth is crucial for starting a new business (see Evans and Jovanovic 1989). This leads to the expectation of a positive sign of the estimated coefficient of the age variable. On the other hand one has to acknowledge that starting a new business often leads to high sunk costs – think of all the effort to set up a business plan, doing market research, dealing with legal and administrative problems, etc. The shorter the expected life span of the new business is, the shorter the period in which these sunk costs can be earned back is. To put it differently, setting up a new business with high sunk costs is more attractive at the age of 45 than at the age of 60, ceteris paribus. This leads to the expectation of a negative sign of the estimated coefficient of the age variable. Given these two op-

posite influences of age on the propensity to become an entrepreneur, it is an empirical question whether one dominates the other, or whether both net out (see Evans and Leighton, 1989). Furthermore, it might be the case that the wealth effect dominates in the early years, while the sunk costs effect dominates towards the end of the active life, leading to an inversely u-shaped relationship between age and the probability to become a nascent entrepreneur. To test for this non-linear influence, age is also included in squares.

- *Level of education* (a dummy variable taking the value one if the interviewee has a higher education, i.e., went to school for at least 12 years, or holds a degree from a polytech or a university). Hypothesis: This dummy variable is a proxy for the amount of general human capital. Given that success in business demands knowledge in a number of different areas and a sufficient capacity to learn, we expect a positive relationship between higher education and the propensity to step into self-employment.
- *Unemployment* (a dummy variable taking the value one if the interviewee is unemployed). Hypothesis: Unemployment often acts as a push factor for building a new business. For Germany, this is amplified by the so-called bridging allowances paid by the labor services to help start-ups by (former) unemployed persons. Therefore, a positive coefficient of the dummy variable is expected (on unemployed nascent entrepreneurs in Germany, see Wagner, 2003c). However, unemployed persons often have a weaker financial background and have a lower level of education, and this contradicts with the push effect.
- *Self-employed* (a dummy variable taking the value one if the interviewee is self-employed). Hypothesis: This dummy variable is a proxy for specific human capital related to running your own business, and a positive coefficient is expected (see Evans and Leighton, 1989). Note that this variable should not be considered to be of a tautological nature. On the one hand, today's self-employed can (and often do) step out of their business and opt for a job as a paid employee. On the other hand, an owner of a business might decide to try another chance in a different area of business – in addition to or instead of the business he is running now.
- *Failed as a self-employed in the past* (a dummy variable taking the value one if an interviewee started – alone or with others – a business in the past that has been closed or given up and not sold to others later). Hypothesis: Like self-employed, this dummy variable is a proxy for specific human capital related to running your own business, and a positive coefficient is expected. Although stigmatization of those who failed once is often seen as a problem (at least in Germany), taking a second chance is widespread (see Wagner, 2003d).
- *Personal contact with a young entrepreneur* (a dummy variable taking the value one if the interviewee personally knows someone who started a new business during the last two years).Hypothesis: Contacts with young en-

trepreneurs will reduce costs because they make it easier to get answers to lots of 'how to' type questions related to a start-up. We expect a positive impact of contact with such a 'role model' (see Sternberg, 2000, 60; Fornahl, 2003).[5]

- *Fear of failure a reason not to start* (a dummy variable taking the value one if the interviewee agreed that fear to fail would prevent him from founding a firm). Hypothesis: If the interviewee answered this question in the affirmative we consider this as an indicator of a high degree of risk aversion, and we expect a negative impact on the probability of becoming a nascent entrepreneur (see Kihlstrom and Laffont, 1979).

Descriptive statistics for these variables are given in the upper panel of table 2.2. Among the nascent entrepreneurs we find more males, more people with higher education, more self-employed, more who failed as a self-employed in the past, and with personal contact to a young entrepreneur, and less people who consider fear of failure to be a reason not to start a new business than among the rest of the adult population. Furthermore, nascent entrepreneurs are about 3.5 years younger on average. Note that the share of unemployed persons in both groups is the same.

Let us now turn to the regional characteristics included in our empirical model that constitute the vector y_j:

- *Population density* (number of residents per square-kilometer in 1998). Hypothesis: Given that the lion's share of new firms is founded in services, a higher population density means more potential customers and higher demand in the region together with market access and market proximity. This has a positive impact on the expected returns to a new business and according to our theoretical framework; we expect this to have a positive influence on the probability to become a nascent entrepreneur.
- *Growth rate of population* (1990–1998; percentages). Hypothesis: The higher the growth rate of population is, the higher the rate of growth of demand for many services is, and the chances for newly founded businesses in these areas are better. Again, this has a positive impact on the expected returns, and, therefore, we expect it to have a positive influence on the probability to become a nascent entrepreneur. Unfortunately, growth rate of gross value added was not available at the regional level for the relevant years.
- *Average price of building plots* (1996–1998; DM per square-meter). Hypothesis: The higher the price of land, the higher the costs for building or renting a flat or shop are, and given this negative impact of higher cost on returns we expect a negative impact of higher prices of building plots on the individual propensity to become a nascent entrepreneur.

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5 Note that this 'cost reduction argument' still holds if contact to a young entrepreneur is endogenous in the sense that someone who has the idea to start a new firm may actively seek contacts with entrepreneurs to collect information.

- *New firms per 1000 residents* (average 1998–2000). Hypothesis: This variable serves as a proxy for the regional entrepreneurial milieu. A high rate of new firm formation points to a climate that is favorable for start-ups in many ways (not measured by the other regional variables included here). Therefore, we expect a positive sign of the estimated coefficient.
- *Ruling political party* (a dummy variable that takes the value one if the Social Democratic Party together with its coalition partners was in a majority position in the regional government in 1997–2001, and zero if the Christian Democratic Union/Christian Social Union together with its coalition partners had the majority). Hypothesis: A social democratic regional government is often said to be less orientated towards business. According to this, a negative sign of the ruling party dummy has to be expected.

Descriptive statistics for these variables[6] are given in the lower panel of table 2.2. Note that on average all regional characteristics included in the empirical model have higher values for the group of nascent entrepreneurs compared to the rest of the adult population. While additional regional variables would be helpful either data for such variables are not available or its values are highly correlated with the new firm formation rate.

4.3 Results of the Econometric Study

The ceteris paribus role played by the elements of x_i and y_j in determining the probability of becoming a nascent entrepreneur is investigated in an econometric model with a dummy endogenous variable taking the value one if a person is a nascent entrepreneur, zero otherwise. When estimating the model, the survey design has to be taken into account. The individuals in our sample are not sampled independently; persons stem from one of ten regions. Because of this sampling design, observations in the same region are not independent. If we use a standard probit model that assumes independence, the reported standard errors may be too small. Accounting for clustering of observations in regions is necessary for "honest" estimates of standard errors. Therefore, we use the survey probit program svyprobit included in Stata 7.0 with the region as the cluster; see StataCorp (2001, 321). Note that spatial

6 The source for population density, growth of population, and average price of building plots is Bundesamt für Bauwesen und Raumordnung (2001); figures for new firms per 1000 residents are calculated from data reported in Statistisches Bundesamt (2001). Information on the government in the regions was collected by the authors. Note that the regional variables included in our model are not highly correlated. The highest correlation coefficient is 0.56 for population density and average price of building plots. Of the other nine correlation coefficients eight are less than 0.27 (in absolute values), and one – population density ruling party – is 0.44. The correlation matrix is available from the fourth author on request.

Table 2.2: Descriptive statistics[1]

Variable	All		Nascent entrepreneurs		Others	
	Mean	Std.	Mean	Std.	Mean	Std. Dev.
Sex (Dummy, 1 = Male)	0.45	0.50	0.64	0.48	0.44	0.50
Age (Years)	43.23	13.49	39.63	11.28	43.35	13.55
Age (squared)	2050.46	1189.69	1697.10	952.33	2062.84	1195.30
Higher education (Dummy, 1 = Yes)	0.38	0.49	0.53	0.50	0.38	0.48
Unemployed (Dummy, 1 = Yes)	0.05	0.21	0.05	0.22	0.05	0.21
Self-employed (Dummy, 1 = Yes)	0.10	0.30	0.34	0.47	0.09	0.29
Failed as a self-employed in the past (Dummy, 1 = Yes)	0.08	0.27	0.24	0.43	0.07	0.26
Fear of failure a reason not to start (Dummy, 1 = Yes)	0.47	0.50	0.23	0.42	0.48	0.50
Personal contact with a young entrepreneur (Dummy, 1 = Yes)	0.43	0.49	0.76	0.43	0.42	0.49
Population density (residents per km^2 in 1998)	405.08	337.97	432.57	334.92	404.11	338.06
Growth rate of population (1990 – 1998, percent)	2.27	4.50	3.10	3.92	2.24	4.51
Average price of building plots (1996 – 1998; DM per square-meter)	217.64	194.68	226.14	189.41	217.34	194.87
New firms per 1.000 residents (average 1998 – 2000)	7.85	1.50	8.08	1.60	7.84	1.50
Ruling political party (1997 – 2001; Dummy, 1 = SPD)	0.50	0.50	0.58	0.50	0.50	0.50
Number of cases	7802		264		7538	

Source: Wagner and Sternberg, 2004, 230; own calculations based on data from the Regional Entrepreneurship Monitor REM Survey, 2001 (upper panel); Bundesamt für Bauwesen und Raumordnung, 2001, Statistisches Bundesamt, 2001, and information collected by the authors (lower panel).

1 For a detailed definition of the variables see text.

autocorrelation is not an issue in our study because the ten planning regions are scattered all over Germany. The estimation proceeds in three steps. In the first step only personal characteristics and attitudes are included in the empirical model, i. e.; the dummy variable for nascent entrepreneurship is regressed on x_i only. Results are reported in the column headed 'Model A' in table 2.3. From the prob-values[7] it follows that according to this model, and in line with our priors, the probability of becoming a nascent entrepreneur is higher for males, people with higher education, unemployed, self-employed, who failed as self-employed in the past, and who have personal contact with a young entrepreneur. It is lower for people with a high degree of risk aversion. All these estimated coefficients are significantly different from zero at the 6 % level of error or better. The effect of age is less clear. The sign pattern points to an inversely u-shaped impact of age; the estimated coefficient of the age variable measured in levels is, however, not statistically significant at a conventional level.

Model A considers the role of personal attributes and attitudes only – and the results are confirmed by other studies based upon data collected during the REM I phase (see Bergmann, 2004). From the descriptive evidence reported in figure 2.1, we know that the level of entrepreneurial activity differs considerably between regions. In the second step, therefore, we additionally test for the role played by the region in determining whether a person becomes a nascent entrepreneur. Results for an augmented empirical model containing nine dummy variables for the regions (using the Emscher-Lippe region as the standard group) are reported in the column headed 'Model B' in table 2.3. All but one of the estimated coefficients of the region dummies are highly significant statistically, and an adjusted Wald test of the null hypothesis that all these coefficients are zero rejects the null with a p-value of 0.0067. Note that the estimated coefficients for the other variables included and their levels of significance do not differ much between Model A and Model B.

With the exception of the ruling political party, the characteristics of the regions all have the theoretically expected signs, and all estimated coefficients are statistically significant at the three percent level or better. According to the findings presented here, higher values of population density and growth, and a higher level of new firm formation intensity have a positive impact on the probability to become a nascent entrepreneur ceteris paribus, i. e., for a given set of personal characteristics and attitudes collected in vector xi, while higher cost for building plots have a negative impact. Bergmann's study

7 We report prob-values instead of t-values for two reasons: First, the degrees of freedom for the t in svyprobit are the number of clusters (i. e., regions) minus one, and not the number of observations minus the number of estimated coefficients, and this might cause irritation; second, the prob-values give an immediate and exact impression of the empirical significance level of an estimated coefficient.

(2004) based upon REM data shows a similar statistical relevance of regional characteristics when he considers their impact on entrepreneurial attitudes and capabilities – and thus (however more in an indirect way) on start-up activities.

Discussion of results hitherto was limited to the statistical significance of the estimated coefficients and the direction of influence conducted by the variables. Information on the extent of this influence, or on the economic significance, however, is even more important. Evidently, a variable that has no statistically significant impact can be ignored from an economic point of view, but the opposite is not true: A variable that is highly significant statistically might not matter at all economically – if the estimated probability for becoming a nascent entrepreneur diminishes by 0.00001% when a person is 68 instead of 18 years old, we can ignore age of a person in any discussion on nascent entrepreneurs irrespective of any high level of statistically significance indicated by the prob-value. Unfortunately, the estimated coefficients from a probit model (or for any other non-linear model) can not easily be used for statements about the size of the ceteris paribus effect of a change of the value of an exogenous variable (e. g., an increase in the age of a person by five years) on the value of the endogenous variable (e. g., the probability of becoming a nascent entrepreneur) because the size of this effects depends on both the value of the exogenous variable under consideration and on the values of all other variables in the model (see Long and Freese, 2001, 87). A way to ease interpretation of the estimation results is to compute the estimated values of the endogenous variable (here: the probability of becoming a nascent entrepreneur) for a person with certain characteristics and attitudes, and then to see how a change in the value of one exogenous variable at a time changes the estimated probability. For expository purposes, we define a reference person – call it person 1 – which is male, 40 years old, has higher education, is unemployed, does not consider fear of failure a reason not to start a new firm, has personal contact with a young entrepreneur, is not self-employed, did fail as a self-employed in the past, and lives in a (fictive) region where all regional variables have values at the sample mean. According to the results reported for model C in table 2.2 the estimated probability for person 1 to become a nascent entrepreneur is 0.216. If we consider a person that is identical to person 1 but female (call it person 2), the estimated probability is 0.159 – much lower. The ceteris paribus impact of unemployment is comparable to the effect of sex – a non-unemployed person 3 has an estimated probability of 0.154. If we look at person 4 who considers fear of failure to be a reason not to start a new firm, we get an estimated probability of 0.141. The probability for person 5, who does not have personal contact with a young entrepreneur, is about half the estimate for person 1, i.e., 0.111. Person 6, who did not fail as a self-employed in the past, has an estimated probability of 0.106 that is about half as big as person 1.

Table 2.3: Estimation results for determinants of becoming a nascent entrepreneur

	Model A		Model B		Model C	
Variable	Coeff.	P>|t|	Coeff.	P>|t|	Coeff.	P>|t|
Sex (Dummy, 1 = Male)	0.2154	0.011	0.2164	0.009	0.2126	0.010
Age (Years)	0.0303	0.126	0.0287	0.160	0.0286	0.158
Age (squared)	-0.0005	0.052	-0.0005	0.066	-0.0004	0.065
Higher education (Dummy, 1 = Yes)	0.1227	0.060	0.1040	0.078	0.1037	0.073
Unemployed (Dummy, 1 = Yes)	0.1959	0.054	0.2332	0.023	0.2318	0.022
Self-employed (Dummy, 1 = Yes)	0.4821	0.000	0.5052	0.000	0.4984	0.000
Failed as a self-employed in the past (Dummy, 1 = Yes)	0.4653	0.000	0.4626	0.000	0.4634	0.000
Fear of failure a reason not to start (Dummy, 1 = Yes)	-0.3052	0.000	-0.2845	0.000	-0.2891	0.000
Personal contact with a young entrepreneur (Dummy, 1 = Yes)	0.4312	0.000	0.4294	0.000	0.4330	0.000
Region Cologne (Dummy, 1 = Yes)			0.2529	0.000		
Region Lueneburg (Dummy, 1 = Yes)			0.1029	0.000		
Region Main-Rhine (Dummy, 1 = Yes)			-0.0230	0.229		
Region Middle Hesse (Dummy, 1 = Yes)			-0.1015	0.000		
Region Middle Mecklenburg (Dummy, 1 = Yes)			-0.2646	0.000		
Region Munich (Dummy, 1 = Yes)			0.1355	0.000		
Region Middle Schleswig-Holstein (Dummy, 1 = Yes)			0.0651	0.000		
Region Stuttgart (Dummy, 1 = Yes)			-0.1282	0.000		
Region Western Saxony/Leipzig (Dummy, 1 = Yes)			-0.1074	0.000		
Population density (residents per km^2 in 1998)					2.64e-4	0.026
Growth rate of population (1990 - 1998, percent)					0.0239	0.000
Average price of building plots (1996 - 1998; DM per square-meter)					-4.27e-4	0.000
New firms per 1.000 residents (average 1998 - 2000)					0.0584	0.004
Ruling political party (1997 – 2001; Dummy, 1 = SPD)					0.0187	0.815
Constant	-1.2678	0.000	-2.6537	0.000	-3.1912	0.000
Number of cases	7802		7802		7802	

[1] The models were estimated by Stata 7 using the program svyprobit with the region as a cluster. The reference region Emscher-Lippe is the omitted region. Source: Wagner and Sternberg 2004, 232

Turning to the impact of the regional characteristics, we will change the regional variables one at a time from their sample means to their sample maxima. If we do so for the population density, the estimated probability for person 8 increases to 0.273 compared to 0.216 for person 1. Setting the growth rate of population to its maximum gives a probability of 0.264 for person 9. Setting the average price of building plots at the sample maximum leads to an estimated probability of 0.163 for person 10. These simulation exercises (and many more not reported here) show that the variables which are statistically significant according to the results reported in table 2.3 are important from an economic point of view, too. The decision to become a nascent entrepreneur is related to the personal characteristics and attitudes, and to characteristics of the region, in a way that is consistent with our theoretical hypotheses. These results are confirmed by related studies of (some of) the authors of this paper based upon REM I data (see Sternberg and Wagner, 2004, Wagner and Sternberg, 2005).

5. Topics in Research in Nascent Entrepreneurship

Besides the papers that used the data collected in the Regional Entrepreneurship Monitor (REM) Germany project to investigate the question what makes a "typical" nascent entrepreneur and to identify personal and regional factors that are statistically significant for the decision to create a new venture or not, there are a number of econometric investigations that tackle more specific issues related to nascent entrepreneurship. This literature is reviewed below, starting with papers that focus on the ceteris paribus impact of one specific personal characteristic, and followed by studies that investigate the ceteris paribus impact of elements of the environment in which a person lives and works.

Gender: In western industrialized countries, men are on average more than twice as active in entrepreneurship as women. Little is known about why this is the case. Based on the REM data, Wagner (2004a) estimates an empirical model for the decision to become self-employed to test for differences between women and men in the ceteris paribus impact of several characteristics and attitudes, taking the rare events nature of becoming an entrepreneur into account. Furthermore, a non-parametric approach using Mahalanobis-distance matching of man and women who are as similar as possible is used to investigate the difference in the propensity to become self-employed by gender. The core finding of this empirical exercise is that considering fear of failure to be a reason not to start an own business has a much smaller negative influence on the propensity to step into self-employment for men than for women – in other words, women tend to be much more risk averse than men. Addition-

ally, women may have bigger problems with combining family and professional duties than men.

Professional background: Recently, Edward Lazear (2002, 2004) proposed the jack-of-all-trades view of entrepreneurship. Based on a coherent model of the choice between self-employment and paid employment, he shows that having a background in a large number of different roles increases the probability of becoming an entrepreneur. The intuition behind this proposition is that entrepreneurs must have sufficient knowledge in a variety of areas to put together the many ingredients needed for survival and success in a business, while for paid employees it suffices and pays to be a specialist in the field demanded by the job taken. Lazear (2002, 2004) and Wagner (2003a) show that this theory is in line with empirical results for self-employed versus paid employees in the U.S. and in Germany, respectively. Using the REM data, Wagner (2003b) tests the jack-of-all-trades hypothesis for nascent entrepreneurs versus persons who decide to continue working as paid employees. He finds evidence for a ceteris paribus positive impact of both the number of fields of professional experience and the number of professional degrees for the decision to become a nascent entrepreneur.

Employment status: Is nascent entrepreneurship different among the unemployed, the employed, and the not employed (i. e., those out of the labor force)? Wagner (2003c) investigates this topic using the REM data. A comparison of the results for the unemployed on the one hand and the employed / not employed on the other hand reveals some remarkable differences: While being male and having a higher education does not matter for the unemployed, it has a positive impact for the other two groups considered here. Age, however, only matters for the unemployed; and considering fear of failure a reason not to start has a negative impact for the employed only. The only individual variable that has the same statistically significant sign for all three groups is the personal contact with a young entrepreneur – the probability of becoming a nascent entrepreneur is higher for anybody with such a contact.

Failure in the past: Folklore has it that the comparatively low proportion of self-employed in Germany is in part due to a habit that might be termed "stigmatization of failure": taking a second chance to build one's own firm after failing as a self-employed person is said to be much more difficult here than in other countries. Wagner (2003d) uses the REM data to document that 8 % of all people whose former firm went out of business are nascent entrepreneurs today, while the share of failed entrepreneurs among the nascent entrepreneurs is 23 %. He investigates the determinants of such a restart. It turns out that both individual and regional factors are important for taking a second chance: this probability is negatively related to age, a high risk aversion, and the share of persons in the region who failed in the past, while it is positively

related to personal contacts with a young entrepreneur and the regional share of nascent entrepreneurs.

Characteristics of the (former) workplace: A stylized fact emerging from a vast number of empirical studies on the inter-regional differences in new firm formation is that the start-up rate in a region tends to be positively related to the share of employees working in small firms, or the proportion of small firms among all firms in the region. A similar point has been made in studies dealing with inter-industry differences in new firm formation. A theoretical explanation for this empirical regularity argues that working in a small firm tends to provide employees with a much more relevant experience for starting a new business (e. g., contacts with customers, and with the owner of the firm who, therefore, provides a role model to follow) than working in a large firm. If this arguments holds, one should expect that people who are working in a small firm (or did so in the past) should have a higher propensity to step into self-employment than others who work(ed) for a large enterprise. A similar argument can be made for those who work(ed) in young firms compared to those in old firms: Through a close contact to a successful entrepreneur, people in a young firm have the opportunity to gather information about the transition from paid employment to self employment with all its problems, and about possible solutions. The "employer-as-a-role-model" argument put forward in the context of the small firm should be even more relevant here because not all small firms are young (and, therefore, not all owners of small firms are role models for potential starters of new firms today), but most of the young firms are small. And we expect it to be most relevant in the case of work experience gathered in young and small firms. Using the REM data, Wagner (2004b) tests the hypothesis that young and small firms are hothouses for nascent entrepreneurs, controlling for various individual characteristics and attitudes. He finds that work experience in a firm that is both young and small is statistically significant and economically important for the decision to become a nascent entrepreneur.

The studies reviewed above that focus on the ceteris paribus impact of specific personal characteristics or on selected elements of the environment a person lives and works in on the decision to start creating a new venture shed some light on important aspects of nascent entrepreneurship. However, given that they each are based on a single data set from a single country, collected in a single point in time, it is an open question whether the results are valid in general. Hopefully, further research attempting to replicate these findings using different data sets will tell.

6. Concluding Remarks

Five years ago we knew next to nothing about nascent entrepreneurs in Germany as a whole, and about inter-regional differences in nascent entrepreneurship activities. The analyses based on the rich data sets collected in the *Regional Entrepreneurship Monitor (REM) Germany* project helped to fill some of the gaps in our knowledge. From the empirical studies summarized above we have evidence about how many nascent entrepreneurs there are, what makes a region more or less entrepreneurial, who the nascent entrepreneurs are, and what role is played ceteris paribus by personal and regional characteristics in determining the probability to become a nascent entrepreneur. Furthermore, we learned about the role of gender and gender-specific differences in risk aversion; the relevance of the professional background; differences among nascent entrepreneurs who are unemployed, employed and out of the labor force; the role of failure as a self-employed in the past and the taking of a second chance; and characteristics of the (former) workplace and the role of small, young firms as 'hothouses' for nascent entrepreneurs.

Obviously, there are many aspects related to nascent entrepreneurship in Germany that are still waiting for investigation. To point to a perspective for future research, we briefly mention some of the more important topics:

What do nascent entrepreneurs do? What are the activities nascent entrepreneurs are involved in when they are actively engaged in creating a new venture of their own? The only way to find out is to ask them, and this has been done in the U.S. in the Wisconsin Entrepreneurial Climate Study conducted in Spring 1993, in a national pilot study for the U.S. done in October / November 1993 (Reynolds, 1997), and in the Panel Study of Entrepreneurial Dynamics (PSED) that started in 1998 (Gartner and Carter, 2003). Furthermore, we have evidence from surveys conducted in Norway (Alsos and Ljunggren, 1998) and in Canada (Diochon et al., 2001); Wagner (2004c, section 3) summarizes the findings from these studies. Unfortunately, we do not have comprehensive and comparable evidence on the set of activities nascent entrepreneurs are involved in, and on the timing of these events, for Germany, because this is a topic that has neither been investigated in the Global Entrepreneurship Monitor project nor in REM. From the evidence we have on start-up activities, it is clear that there is neither a fixed set of events (although some events are more common than others) nor a uniform sequence. The industry, the region, and personal factors (like gender, skills, and financial reserves of the nascent entrepreneurs) all matter in determining what a nascent entrepreneurs does, and when.

What happens to nascent entrepreneurs and why? Not all nascent entrepreneurs see their vision through to an eventual start-up in some given period of time (say, in a year after they outed themselves as nascent entrepreneurs in a

survey) – some give up, and others are still trying. A number of studies for countries from North America (United States and Canada) and Europe (Austria, Germany, Italy, the Netherlands, Sweden and Norway) report empirical findings on the proportions of these sub-groups, and on variables that differentiate between them. Wagner (2004c) summarizes the findings and looks at differences and similarities across space. For Germany, Bahß, Lehnert and Reents (2003) use data from the KfW-Gründungsmonitor project to investigate how many of those persons who stated in April – July 2002 that they intend to step into self-employment during the next six month did so by February 2003. From the 300 participants in this follow-up survey, 29 % were indeed self-employed, 21 % were still trying, 32 % delayed their project, and 18% gave up. The authors mention that unemployed more often stop the process of setting up a new venture compared to paid employees, and that "starters" and "stoppers" do not differ in important personal characteristics like risk aversion and aspiration for independence; details, however, are not reported. Given that those who state in a survey that they intend to become self-employed in the next half year can not be considered to be nascent entrepreneurs according to the definition given in section 2 above, these findings are not strictly comparable to the results reported in other studies. However, they provide the only information available for Germany that at least comes close to, given that no longitudinal study on German nascent entrepreneurs has been done as yet (see Bergmann, 2000 for a fruitless attempt to use the German household panel SOEP for an investigation of this topic).

How and why do migrants differ from non-migrants with respect to start-up activities? From international, comparative and empirical research like GEM, it is well-known that entrepreneurial activities differ between migrants and inhabitants without any migration background (see, e.g., Harding, 2004 for the UK). According to GEM data, the total entrepreneurial activity rate (TEA)[1] was 5.0 % in Germany 2003 for 18-64 year old persons entitled to vote (as proxy for non-migrants), whereas among adults not entitled to vote (as a proxy for migrants) respective percentage was 9.9 %! Our hypothesis would be that such start-ups created by migrants are more unevenly distributed across German regions than start-ups created by non-migrants. From other research work it is known that this hypothesis is of empirical validity if

1 As described in previous section, within REM (and GEM) an individual may be considered a "nascent entrepreneur" based on three conditions: first, if he or she has done something – taken some action – to create a new business in the past year, if he or she expects to share ownership of the new firm; and, third, if the firm has not yet paid salaries and wages for more than three months. In cases where the firm already exists and the interviewee is the owner and he or she has paid salaries and wages for more than three but less than 42 months, it is classified as a "new business" and the individual is classified as a "young entrepreneur". The TEA rate is the sum of the two previous measures; those persons who qualify as both a "nascent entrepreneur" and a "new business" are counted only once, however.

such migrants are return migrants as Müller (2004) reports for Chinese return migrants. These return migrants can be responsible for a significant part of all entrepreneurial activities within a given region, as Saxenian (2000) has shown. However, it is assumed that such entrepreneurial behavior of migrants differs between regions within Germany as well – given the uneven distribution of ethnic minorities between (and within) German regions and the ethnic-specific entrepreneurial activities. Due to the fact that the economic role of migrants will increase in all German regions in the future (however, to a different extent between the regions), it would be worthwhile to analyze empirically the role of start-ups by current and future migrants.

How and why do the locational preferences of nascent entrepreneurs and young entrepreneurs change over time? The spatial immobility of individuals which have started a firm is supported by empirical evidence based upon numerous studies (see Sternberg et al., 1997 for start-ups in German business incubators). However, much less is known about the relevance of this spatial immobility when firms are getting older. Due to an increasing importance of national and international demand (compared to local demand) and changed relevance of hard and soft locational factors a new firm location could be a reasonable reaction when start-ups grow (Meester, 2004). On the other hand, young owner-managed firms still need their reliable local personal networks of friends, fools and families even if they are more established. With the help of panel studies it might be possible to shed an empirical light on the hypothesis that the relevance of intra-regional networks and spatial immobility decrease over time. Implications for the role of start-ups within a policy strategy of endogenous regional development (see Sternberg, 2003) are obvious.

How, when and where should start-up policies support nascent entrepreneurs or potential nascent entrepreneurs? Finally, the available and future studies based upon REM data potentially offer a variety of possibilities to develop recommendations for local and regional start-up policies. For some ten years now, there have been a large, and still increasing, number of promotional programs in Germany aimed explicitly or implicitly at supporting entrepreneurial activities. These programs, which take effect in Germany and its regions, have been established by the European Union, individual federal ministries (... for Economics and Labor, ... for Education and Research), ministries of the individual federal states and individual municipalities. First results with REM data show for the selected ten REM regions the statistical relationship between policy instruments and start-up activities seems to be only modest (Sternberg, 2005). However, much more empirical research is needed to recover the interdependent relationship between entrepreneurial activities and policy instruments to support start-ups. As shown before, the REM regions are divided up on the basis of the 97 planning regions, which do not represent any official delineation of regions. Consequently, there are no

entrepreneurship promotion programs, which apply exclusively to individual REM regions. It is, therefore, not possible to evaluate existing public policy instruments directly using REM data. Significant research deficits exist in terms of time lags. The discussion of policy impacts on an individual's decisions and the intended regional development effects must be interpreted as a complex system of interdependent relationships between at least two factors. Entrepreneurial activities are the result of the personal perception of the entrepreneurial framework conditions (and the related policies) of the individuals living in a region – as explained in a previous section.

To conclude, and to put our own findings into perspective, we point out that stylized facts that could be most valuable for entrepreneurship researchers, policy makers, and, last but not least, nascent entrepreneurs, need to be based on results from a number of studies using large, comprehensive longitudinal data bases that are comparable across time and space, and that can be accessed by researchers for replication and extension of former studies. The *Global Entrepreneurship Monitor (GEM)* and the *Panel Study of Entrepreneurial Dynamics (PSED)* projects, and the data collected within these projects, are important steps towards this aim at the level of countries as a whole. The high importance of new firms for economic dynamics, and the high importance of nascent entrepreneurs for new firms, point to the need for further steps in the future. With a focus on the region and inter-regional differences in entrepreneurship activities inside countries, these steps should include further waves of the Regional Entrepreneurship Monitor (REM) Germany and comparable projects in other countries.

References

Acs, Zoltan, Pia Arenius, Michael Hay and Maria Minniti, 2005, *Global Entrepreneurship Monitor 2004 Executive Report.* London, Wellesley: London Business School and Babson College.

Acs, Zoltan and Catherine Armington, 2004, Employment growth and entrepreneurial activity in cities. *Regional Studies,* 38, 911-928.

Alsos, Gry Agnete and Elisabet Ljunggren, 1998, *Does the Business Start-Up Process Differ by Gender? A Longitudinal Study of Nascent Entrepreneurs. Frontiers of Entrepreneurship Research.* Babson College, Wellesley: MA.

Bahß, Christian, Nicole Lehnert and Nicola Reents, 2003, *Warum manche Gründungen nicht zustande kommen. KfW-Research*, Nr. 10, Oktober, 2-9.

Bergmann, Heiko, 2000, *Gründungspotenzial und Gründungsengagement im Spiegel des Sozioökonomischen Panels (SOEP).* Essen: RWI.

Bergmann, Heiko, 2004, *Gründungsaktivitäten im regionalen Kontext. Gründer, Gründungseinstellungen und Rahmenbedingungen in zehn deutschen Regionen.* Köln: Wirtschafts- und Sozialgeographisches Institut der Universität zu Köln (= Kölner Forschungen zur Wirtschafts- und Sozialgeographie, 57).

Bergmann, Heiko, Andrea Japsen and Chistine Tamásy, 2002, *Regionaler Entrepreneurship Monitor (REM). Gründungsaktivitäten und Rahmenbedingungen in zehn deutschen Regionen.* Universität zu Köln, Universität Lüneburg.

Bundesamt für Bauwesen und Raumordnung, 2001, *Aktuelle Daten zur Entwicklung der Städte, Kreise und Gemeinden,* Ausgabe 2000. Bonn: Bundesamt für Bauwesen und Raumordnung.

Diochon, Monica, Yvon Gasse, Teresa Menzies and Denis Garand, 2001, From conception to inception: Initial findings from the Canadian Study on Entrepreneurial Emergence. London, Ontario: Proceedings of the Administrative Science Association of Canada, *Entrepreneurship Division,* Volume 22 (21), 41-51. May 26-29.

Evans, David S. and Boyan Jovanovic, 1989, An estimated model of entrepreneurial choice under liquidity constraints. *Journal of Political Economy,* 97, 808-827.

Evans, David S. and Linda S. Leighton, 1989, Some empirical aspects of entrepreneurship. *American Economic Review,* 79, 519-535.

Fornahl, Dirk, 2003, Entrepreneurial activities in a regional context. In: Fornahl, Dirk and T. Brenner (eds), *Cooperation, networks and institutions in regional innovation systems.* Cheltenham UK, Northampton MA: Edward Elgar, 38-57.

Fritsch, Michael and Pamela Mueller, 2004, Effects of new business formation on regional development over time. *Regional Studies,* 38, 961-977.

Gartner, William B. and Nancy M. Carter, 2003, Entrepreneurial Behavior and Firm Organizing Processes. In: Zoltan J. Acs and David B. Audretsch (Eds.), *Handbook of Entrepreneurship Research (International Handbook Series on Entrepreneurship, Volume 1).* Boston etc.: Kluwer Academic Publishers, 195-221.

Harding, Rebecca, 2004, *Global Entrepreneurship Monitor United Kingdom 2003.* London: London Business School.

Kihlstrom, Richard E. and Jean-Jaques Laffont, 1979, A general equilibrium entrepreneurial theory of firm formation based on risk aversion. *Journal of Political Economy,* 87, 719-748.

Japsen, Andrea, 2002, *Regionaler Entrepreneurship Monitor 2001 - Methodenbericht.* Universität Lüneburg, Fachbereich Wirtschafts- und Sozialwissenschaften: Arbeitsbericht No. 271.

Lazear, Edward P., 2002, *Entrepreneurship.* National Bureau of Economic Research Working, No. Paper 9109, August, [Download: www.nber.org/papers/w9109].

Lazear, Edward P., 2004, Balanced Skills and Entrepreneurship. *American Economic Review – Papers and Proceedings*, 94 (2), 208-211.

Long, J. Scott and Jeremy Freese, 2001, *Regression models for categorical dependent variables using Stata.* College Station, TX: Stata Press.

Lückgen, Ingo and Dirk Oberschachtsiek, 2004, *Regionaler Entrepreneurship Monitor (REM II 2003/2004). Zur Dynamik von Gründungsaktivitäten in Deutschland: Ausmaß und Ursachen.* Universität zu Köln, Universität Lüneburg.

Lückgen, Ingo and Dirk Oberschachtsiek, 2005, *Regionaler Entrepreneurship Monitor (REM II 2003/2004) - Methodenbericht.* Universität Lüneburg, Fachbereich Wirtschafts- und Sozialwissenschaften: Arbeitsbericht No. A329.

Meester, Wilhelm J., 2004, *Locational Preferences of Entrepreneurs.* Heidelberg, New York: Physica.

Müller, Claudia, 2004, *Entrepreneurship and Technology Transfer by Chinese Return Migrants - a Theoretical and Empirical Contribution to the Reverse Brain Drain Discussion.* Cologne: Department of Economic and Social Geography (=Working Paper No. 2004-01).

Parker, Simon, 2004, *The Economics of Self-Employment and Entrepreneurship.* Cambridge etc.: Cambridge University Press.

Reynolds, Paul D., 1997, Who Starts New Firms? – Preliminary Explorations of Firms-in-Gestation. *Small Business Economics*, 9, 449-462.

Reynolds, Paul, Niels Bosma, Erkko Autio and others, 2005, Global Entrepreneurship Monitor: data collection design and implementation 1998-2003, *Small Business Economics,* 24, 205-231.

Saxenian, Annalee, 2000, *Silicon Valley's New Immigrant Entrepreneurs. Working Paper No. 15.* San Diego: The Center of Comparative Immigration Studies.

StataCorp., *2001, Stata User's Guide, Release 7.* Stata Corporation, College Station, TX,.

Statistisches Bundesamt, 2001, *Statistik regional, Ausgabe 2001, CD-ROM.* Wiesbaden: Destatis.

Sternberg, Rolf et al, 1997, *Bilanz eines Booms - Wirkungsanalyse von Technologie- und Gründerzentren in Deutschland.* Dortmund: Dortmunder Vertrieb für Bau- und Planungsliteratur (2nd edition).

Sternberg, Rolf, 2000, *Entrepreneurship in Deutschland. Das Gründungsgeschehen im internationalen Vergleich. Länderbericht Deutschland 1999 zum Global Entrepreneurship Monitor.* Berlin: Edition sigma.

Sternberg, Rolf, 2003, Das Konzept endogener Regionalentwicklung – Implikationen für Existenzgründungen und deren Förderung. In: Sternberg, Rolf (Hrsg.), *Endogene Regionalentwicklung durch Existenzgründungen? Empirische Befunde aus Nordrhein-Westfalen.* Hannover: Akademie für Raumforschung und Landesplanung (ARL), 4-19 (= Arbeitsmaterialien der ARL, 299).

Sternberg, Rolf, 2005, Entrepreneurship in German regions - empirical evidence from the Regional Entrepreneurship Monitor (REM). In: Audretsch, David, Heike Grimm, and Wessner, C.W. (eds.): *Local heroes in the global village. Globalization and New Entrepreneurship Policies.* New York: Springer, 113-144.

Sternberg, Rolf and Ingo Lückgen, 2005, *Global Entrepreneurship Monitor (GEM). Länderbericht Deutschland 2004.* Cologne: University of Cologne, Department of Economic and Social Geography.

Sternberg, Rolf and Wagner, Joachim, 2004, The Decision to Start a New Firm: Personal and Regional Determinants. Empirical Evidence from the Regional Entrepreneurship Monitor (REM) Germany. In: Fritsch, Michael and Michael Niese (Eds.): *Gründungsprozess und Gründungserfolg. Interdisziplinäre Beiträge zum Entrepreneurship Research.* Heidelberg: Physica, 19-38.

Van Stel, André, Martin Carree and Roy Thurik, 2005, The effect of entrepreneurial activity on national economic growth. *Small Business Economics,* 24, 311-321.

Wagner, Joachim, 2003a, Testing Lazear's Jack-of-All-Trades View of Entrepreneurship with German Micro Data. *Applied Economics Letters*, 10, 687-689.

Wagner, Joachim, 2003b, Are Nascent Entrepreneurs Jacks-of-All-Trades? A Test of Lazears's Theory of Entrepreneurship with German Data. *Applied Economics* (forthcoming).

Wagner, Joachim, 2003c, *The Impact of Personal Characteristics and the Regional Milieu on the Transition from Unemployment to Self-Employment: Empirical Evidence for Germany.* Jahrbücher für Nationalökonomie und Statistik 223, 204-222.

Wagner, Joachim, 2003d, Taking a Second Chance: Entrepreneurial Re-starters in Germany. *Applied Economics Quarterly*, 49, 255-272.

Wagner, Joachim, 2004a, What a Difference a Y Makes: Female and Male Nascent Entrepreneurs in Germany. *Small Business Economics* (forthcoming).

Wagner, Joachim, 2004b, Are Young and Small Firms Hothouses for Nascent Entrepreneurs? Evidence from German Micro Data, *Applied Economics Quarterly*, 50, 379-391.

Wagner, Joachim, 2004c, *Nascent Entrepreneurs.* Institute for the Study of Labor IZA Discussion Paper No. 1293, September.

Wagner, Joachim and Rolf Sternberg, 2004, Start-up activities, individual characteristics, and the regional milieu: Lessons for entrepreneurship support policies from German micro data. *Annals of Regional Science,* 38, 219-240.

Wagner, Joachim and Rolf Sternberg, 2005, Personal and regional determinants of entrepreneurial activities: Empirical evidence from the Regional Entrepreneurship Monitor (REM) Germany. *Jahrbuch für Regionalwissenschaft*, 25, 91-105.

Wong, Poh Kam, Yuen Ping Ho and Erkko Autio, 2005, Entrepreneurship, Innovation and Economic Growth: Evidence from GEM Data. *Small Business Economics*, 24, 335-350.

3 THE SPATIAL EMBEDDEDNESS OF NETWORKS FOR WOMEN ENTREPRENEURS

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1. Introduction

Unlike well established firms, new businesses have to build up their resource base and gain legitimacy in the market. Here, networks provide access to opportunities and resources such as local contacts to customers and suppliers, information on potential business partners as well as advice and mentoring from established entrepreneurs. Some research has shown an association between successful entrepreneurship and involvement in networking activity (e.g. Birley et al., 1991; Brüderl and Preisendörfer, 1998; Chell and Baines 1998; Jenssen, 2001). With respect to women entrepreneurship, social capital can take on additional importance, since it can contribute to entrepreneurial confidence, thus assisting women entrepreneurs in overcoming resource barriers.

So far, most entrepreneurship research has studied networks and their role in fostering (female) entrepreneurship and firm growth from the perspective of the entrepreneur and/or from a cultural viewpoint (e.g., Havnes and Senneseth, 2001; Dodd and Patra, 2002; Lechner and Dowling, 2003), while research from regional sciences mainly focused on success factors for regional innovative milieus. There still seems to be 'less concern with networking between institutions that form the infrastructure and support environment that is crucial to successful development', as already noted by Deakins and Philpott in 1995 (p. 47). Only a few studies concentrate on the links between entrepreneurs' networks and the local and regional institutional support structure for the creation of new firms (e.g., Nilsson, 1997), although one might assume that this is to be one of the ingredients in developing 'entrepreneurial' regions.

In this context, the paper investigates the spatial embeddedness of networks for and of women entrepreneurs, with a particular emphasis on the emergence of networks and cooperation between networks. The paper concentrates on the institutional 'formal' network structure of a region, which includes public, semi-public and private support networks, voluntary (women) entrepreneurs' networks as well as professional associations and networks generally aimed at women. In particular, we are interested in the development of networks over

time, relationships, and interactions between different types of networks and support structures, the spatial characteristics of different types of networks, and, finally, possible implications for developing regional milieus which foster entrepreneurship. More specific research questions include: Which local/regional actors are involved in fostering (women) entrepreneurship? Which role do they play? How did networks and network cooperation evolve over time? Which relations exist between women (entrepreneurs) networks and (semi-)public or private support networks in terms of formality and intensity? Which factors influence inter-organizational cooperation? What are the lessons for fostering an entrepreneurial local climate in different urban settings?

This chapter consists of four parts. The first part contains a conceptual review, followed by a short description of the methodology and the two sample areas. The empirical results will be presented in part three, while part four discusses conclusions and implications.

2. Conceptual Review: Networks and (Women) Entrepreneurship in Different Regional Settings

2.1 Overview of Current Research on Networks, Networking and (Women) Entrepreneurship

Most current network research focuses on networks and networking from an individual perspective. Networks can be understood as 'a configuration of firms, owner-managers, support agencies, voluntary associations, and other bodies through which small firms connect to the wider economy' (Curran et al., 1995). With regard to women entrepreneurs, gender differences in network structure and networking behavior may influence both the decision to start and to develop a business as well as business survival and success (Carter et al., 2001). Some research indicates gender-specific deficits in networking contacts of female entrepreneurs. For example, Allen (2000) reports women networks as including fewer entrepreneurs, which might restrict their outreach and usefulness for a female entrepreneur. Other studies report women entrepreneurs' networks as more homogeneous (e.g., Renzulli et al., 1999) and less outreaching, less frequent network activities of women entrepreneurs (e.g., Carter et al. 2001, Caputo and Dolinsky, 1998; Schutjens and Stam, 2003) and a tendency for women entrepreneurs to concentrate on strong ties (e.g., Döbler, 1998).

Yet another strand of research emphasizes the quality of informal networking ties, including marriage and the extended family, as the decisive factor in facilitating or constraining female entrepreneurship. Renzulli et al. (1999) indicate that gender does not matter, but a greater proportion of kin in female networks which could create a disadvantage to entering entrepreneurship. In

addition, Brüderl/Preisendörfer (1998) found support from strong tie networks, especially family support, as a decisive factor on business success. On the whole, results are sparse. While gender differences in network structures appear to be an accepted empirical result contributing to differences in women entrepreneurship, the results on network contents and network frequency are not conclusive, leading McManus (2001) to raise the point that research still has to prove empirically the facilitating effect of networks and networking towards entrepreneurship.

Overall, many research studies have demonstrated that networks and network contacts are important during the establishment, development and growth of business (e.g. Birley et al., 1991, Brüderl/Preisendörfer 1998, Chell and Baines 1998). Social networks play a role in mobilizing complementary resources, getting support and help, and establishing viable business relations. For example, Jenssen (2001) analyzes the impact of social networks on start-up success, demonstrating that social networks have both a direct and an indirect effect on the degree of start-up success. This especially applies to the number of initial weak ties and emerging strong ties. Here, micro enterprises might experience disadvantages due to limited time resources of their owners, as indicated by low participation rates in social networking (Katz and Williams, 1997, 195, Curran and Blackburn, 1994, 171).

Although most empirical studies confirm a link between networking and positive business development, the evidence is not conclusive whether strong ties or weak ties matter the most. In their review on network studies, Hoang and Antoncic (2003) conclude that the respective outcome seems to depend on the operationalization of network variables to a large extent.

2.2 Network Emergence and Network Actors

Why do networks emerge? Transaction cost theory provides one answer. In the case of entrepreneur's networks, the individual (nascent) entrepreneur seeks to reduce risks, uncertainties, and information costs connected with business formation and development through the interaction with like-minded people. Networks emerge in situations where the costs of participating in a network are lower compared to the benefits of the membership. Moreover, entrepreneurship research indicates that it is not only transactions costs which matter for network emergence but also properties inherent in social capital (Anderson and Jack, 2003), such as affinities, communalities and joint interests.

Only a few studies so far have researched the *emergence of networks* (e.g., Human and Provan, 2000; Neergaard, 1998; Sarasvathy and Dew, 2003), mainly focusing on network relations between entrepreneurs. With regard to how new networks may be initiated, Sarasvathy and Dew (2003) suggest a simple typology: Networks either emerge spontaneously and through random

chance (also Neergaard, 1998); they may form in "some path dependent fashion" (Sarasvathy and Dew, 2003, 13), or they result from deliberate actions of an existing network.

Similar to new businesses, networks also need to acquire legitimacy. In a 'pre-phase' of network development, those interested in creating a network start developing common interests and objectives, thus, legitimating their need for networking (Human and Provan, 2000). In this phase, individual interests and objectives dominate, determining who may join the network and the network's internal identity (Sarasvathy and Dew, 2003). Human and Provan (2000) found that during the formation phase networks mainly rely on two strategies, namely an internal-external oriented strategy and vice versa. The former appears to be more successful in early stages of network emergence, as it focuses on creating internal legitimacy and functioning organization structures without neglecting external stakeholders. In comparison, an external-internal oriented strategy concentrates on external stakeholders in searching for legitimacy, and it neglects building up the network's identity and functioning working structures.

Networks are initiated and driven by persons; and recent research studies emphasize the role(s) *network promoters play in network emergence and development* (Axelsson and Larsson, 2002; Koch 2003, Koch et al., 2003). In a study on network structures in Gnosjö, a Swedish industrial district, Axelsson and Larsson (2002) identified typical forms of networks, all of which are based on the different roles network actors play: The 'locomotive-driven network' is one which is initiated and dominated by one actor, while a 'joint umbrella' describes a network structure which is driven by members and their joint interests. Referring to research by Miles et al. (1992), the authors emphasize three key actors for networks to be successful: the 'architect' brings in a vision for the network and is capable of structuring the network along these lines; the 'lead operator' fulfils a bonding function within the network; and the 'caretaker' focuses on developing and improving the network (Axelsson and Larsson, 2002, 98).

Applying the concept of innovation promoters, Koch et al. (2003) showed that actors within networks often act as process and relationship promoters, which implicitly refers back to the ideas presented by Miles et al. (1992, cited in Axelsson and Larsson, 2002) and Axelsson and Larsson (2002). The authors, furthermore, demonstrate that different promoter roles and network positions go hand in hand. For example, relationship promoters often had a full time job and a central position within the network. In this context, the works on the creative milieu suggest that high communicators play an important role for network development. High communicators are individuals at the decision making level in several public and private organizations. They play a central role in transmitting information, speeding up decision-making, and fostering inter-organizational linkages (Fromhold-Eisebith, 1995, 38). Such key individuals contribute to the development of 'institutional thickness' by bringing

in local knowledge and the ability to access and link local capacity at different levels (Malecki, 1997, 91 with reference to Amin and Thrift, 1994).

With regard to our empirical study, we, therefore, propose that personal factors play an important role for the emergence and later development of networks, while an internal-external strategy favors network survival.

2.3 Spatial Success Factors for Network Development

Studies analyzing spatial success factors for the development of entrepreneurship networks are rare. Therefore, we draw on theoretical approaches from the wider field of economic geography, namely the concepts of *Creative Milieus, Localized Learning, and Endogenous Regional Development.* These concepts mainly focus on spatial factors supporting innovation, but they also provide clues for our topic.

Ideally, a regional support system for entrepreneurship promotion would be characterized by a clear division of labor between different actors. For example, (semi-)public institutions could offer support for new enterprises, entrepreneur's networks could focus on later stages of business formation while both groups would be actively involved in public relations (Schmude, 2001; Große et al., 2002). In this context, some authors emphasize the necessity to integrate the different fields of regional entrepreneurship promotion better (Butler and Hansen, 1991, Nilsson, 1997). With regard to *regional actors and their role in fostering entrepreneurship* Camagni (1991, 1995) and Malecki (1997) point out the broad range of actors which is needed to form an institutional net in the region aimed at fostering entrepreneurship. This includes government on different levels, universities and other (higher) educational institutions, chambers of commerce and business associations, (local) banks, incubators, and private support groups such as firms' or entrepreneurs' networks. In this context, networks serve as a platform where different actors involved in regional enterprise support can exchange information and pool know-how on those spatial factors, which influence entrepreneurship. This further stimulates learning processes, which generate region-specific tacit knowledge, thus creating competitive advantages in supra-regional competition (Camagni, 1991, Maskell et al., 1998). In this regard, large incubators like universities, which assemble widely acknowledged and engaged scientists, may contribute in particular to the development of an 'entrepreneurial social infrastructure' (Backes-Gellner et al., 2002, 80). They can provide services which support the emergence of high-quality networks aimed at the stimulation of collective learning processes. Based on such university linked networks of young entrepreneurs, a self- reinforcing process might be initiated, leading to regional new firm cluster (Sternberg, 2003, 10).

The types of *networks and interrelationships* that evolve in a particular territory depend on the historical, cultural, social, and political settings as well as

on the economic conditions (Malecki, 1997, 92). Densely urbanized areas favor the development of entrepreneurs' networks and thick inter-organizational relations, since they regularly contain a large number of (nascent) entrepreneurs, support organizations, network promoters, and high communicators. However, in remote and less urbanized territories with only a few entrepreneurs and potential 'key individuals' present, municipal officers who are not normally involved in fostering entrepreneurship may initiate the respective activities. Examples include school headmasters (Malecki, 1997, 91). Therefore, network emergence and development strongly depends on regional settings (Price, 2004, 470).

Which factors influence *inter-organizational cooperation* aimed at *fostering a local climate which is conducive for entrepreneurship?* For (semi-)public institutions as well as for network organizations, Bathelt (1998) and Porter (2000) pointed out the need to systematically use the competencies of local entrepreneurs in order to design policies, which are aiming at fostering regional economic development. It depends on local circumstances whether entrepreneurs are involved through public-private-partnerships or even a private sector leadership. Fürst (2001) emphasizes that local governments should support different forms of collective learning in their territory through fostering interrelations between local universities, adult education centers and entrepreneurs organizations. This should include linkages across regions (Camagni, 1995), as inter-regional cooperation can help in preventing regional 'lock-ins' and inertia because regional actors may learn from each other's experiences in fostering entrepreneurship (Grabher, 1993).

With regard to remote, less urbanized areas Spannowsky et al. (2002) stress the need for a systematic long-term support of so-called 'connecting institutions' (Buhmann et al., 2002, 158) by regional development agencies. They should provide decentralized counseling services for entrepreneurs, support the formation of entrepreneurs' organizations and help to establish links between them and local authorities in order to sustain the bottom-up initiatives of local entrepreneurs. However, public actions of local and regional development authorities and support for inter-organizational cooperation also require adequate funding in order to provide for sustainable support structures (Sternberg, 1995).

Finally, on an individual level, informal face-to-face contacts are considered essential for creating a regional network of institutions involved in fostering innovation and entrepreneurship (Fromhold-Eisebith, 1995, 37). This underlines the importance of high communicators and network promoters also from a spatial perspective; and it indicates trust as the 'lubricant' for network activities.

With regard to our explorative empirical study, we propose that the existence of an entrepreneurial infrastructure, which would consist of several anchor points in (semi-)public institutions, social and educational organizations provides a good basis for the 'bottom- up' emergence and spatial embedded-

ness of entrepreneurs' networks. In less urbanized regions, the existence of 'connecting institutions', which also would need sustainable funding, is of particular importance.

3. Empirical Design

3.1 Methodology

Empirically, the paper draws on two regional case studies conducted within a larger research project on the importance of networks supporting women start-ups, which was commissioned by the Federal Ministry of Economic Affairs. The project was carried out jointly by the Rhine-Westphalia Institute of Economic Research Essen (RWI) and the sfs Dortmund (that is the Federal State Institute of Labor Research, project manager: Ursula Ammon) from 2003 to 2004 (cf. Welter et al., 2004). The study analyzed the emergence, development, organization, management, and regional embeddedness of selected networks for and of women entrepreneurs, in order to identify structural and spatial strengths and weaknesses. Methodologically, the project employed a multi dimensional approach, combining qualitative elements (document analysis, in-depth interviews) on the supply side (i.e., the networks) with a standardized online survey of female network users[1] and regional case studies. This paper reports results from two of our three regional case study regions, where we mapped network structures in different regional settings, namely the City of Munich, selected urban centers in the State of Mecklenburg-Western Pomerania and the Eastern part of the Ruhr Area. Here, we concentrate on the first two regions.

In order to select regional interview partners, we employed the following steps. Firstly, for the 'supply-side' study, typical networks for women entrepreneurs were selected. We used the following criteria to identify typical network forms:

- Organization structures: Are networks operating as 'real' structures? Or are they virtual, i.e., Internet-based structures?
- Outreach: Do the networks operate on a national level with regional or local subgroups? Or do they mainly operate locally?
- Target group: Are networks solely focused on entrepreneurs? Or are they targeting employees and managers, i.e., potential entrepreneurs?
- Gender: Is membership restricted to women? Or are both women and men members?

Secondly, for our regional case studies we identified regional branches of national associations and networks. Furthermore we searched the Internet in

1 For further information on the methodology of the online survey and problems involved in identifying network users cf. Welter et al. (2004).

order to identify the overall support structures within the case study regions. Besides regional branches of national networks, this includes local networks of women (entrepreneurs) and business associations, (semi-)public organizations involved in entrepreneurship promotion as well as other support networks fostering women entrepreneurs such as university initiatives, business incubators and advisory centers. Thirdly, twenty three semi-structured in-depth interviews were carried out in both regions from March to May 2004, supplemented by document analysis and, where necessary, telephone calls to clarify open points.

3.2 Sample Areas

Before we report the results from our explorative regional study, this section gives some background information on the sample areas. The *East German State of Mecklenburg-Western Pomerania* (MWP) is characterized by a very low population density (1.76 Mio inhabitants, 76 pers./sqkm) and a settlement structure which reflects the traditional rural character. Around one third of the population lives in villages, one quarter in small towns with up to 20,000 inhabitants, and around 20 percent in medium-sized cities and in the two big cities Rostock and Schwerin, respectively (Weiss, 1996). The state had to undergo a tremendous socio-economic transition process for the past 15 years, characterized by a thorough restructuring of the industrial and agrarian base. Since the early 1990s, ten thousand employees were released from the shipbuilding industry, food industries, large agricultural cooperatives, the military, and even the tourism sector.

Table 3.1: Unemployment rates in comparison, 1998 -2002 (annual average rate, in %)

	1998	1999	2000	2001	2002
Germany	11.1	10.5	9.7	9.4	9.8
State of Mecklenburg-Western Pomerania	20.1	19.2	18.9	19.5	20.1
Rostock (city)	19.5	17.8	16.2	17.0	18.3
Munich (region)	6.4	5.8	4.8	6.7	5.6
Munich (city)	7.3	6.6	5.5	5.2	6.6

Federal Employment Service's (2003).

At present, the state of MWP is characterized by one of the highest unemployment rates in Germany (approx. 20 percent) and low private disposable incomes (tables 3.1, 3.2). Moreover the demographical structure changed drastically due to the ongoing emigration of young and well qualified persons who are in search of job opportunities. Entrepreneurship, measured as self-employment, grew from 40,000 to nearly 60,000 from 1990 and 2001, although this by far could not substitute for the job loss in former state owned companies. On the whole, the self-employment rate of MWP is still lower

compared to East Germany and Germany as a whole (in 2002: 8.2 percent versus 8.6 percent and 10.3 percent). Self-employed persons are mainly engaged in service businesses such as retail trade, catering and tourism, health services, education, and enterprise related consultancy, but they are also to be found in the IT/New Media sector (FGB MWP, 2000).

Table 3.2: Private disposable income in comparison, 1996 - 2001 (per person in €)

	1996	1997	1998	1999	2000	2001
Germany	14,290	14,580	14,959	15,461	15,930	16,485
State of Mecklenburg-Western Pomerania	11,655	11,928	12,175	12,802	13,197	13,560
Rostock (city)	12,134	12,477	12,771	13,597	13,915	14,244
Munich (region)	17,937	18,502	19,266	19,639	19,881	20,555
Munich (city)	18,507	19,158	19,956	20,326	20,566	21,230

Federal Statistical Office (2003).

The second region, the *City of Munich and its (proximate) hinterland* are considered the number one High Tech Region in Germany, with around 15 percent of all industrial R&D-employees in Germany in the late 1990s. This development was initiated shortly after the Second World War by the move of the electronic and IT giant Siemens from Berlin to Munich, accompanied by strong state support fostering public science and R&D-infrastructure (Sternberg and Tamásy, 1999; Sternberg, 2000). Moreover, the region, with its 2.5 million inhabitants, is characterized by a large and prosperous service and public sector. All this is reflected in a comparatively low unemployment rate and high private disposable incomes (tables 3.1, 3.2), while the self-employment rate is remarkably higher than the German rate (in 2001, 11.3 percent in Munich compared to 10.3 percent in Germany).

4. Empirical Results: Networks in the Region

4.1 Network Development in Mecklenburg-Western Pomerania

In the early 1990s, all East German states faced a major challenge because they had to establish and rebuild institutional and government structures at state, regional, and local level. Therefore, during the early stages of the transformation process, state authorities and semi-governmental institutions did not immediately focus on providing comprehensive support for (women) entrepreneurs, while women entrepreneurs initially concentrated on setting up their own ventures before they turned to initiating network organizations. Nevertheless, in MWP some support measures for women entrepreneurship were set up in the early 1990s, and gradually more and more regional and local actors became involved in fostering women entrepreneurship. At the pre-

sent time, in urban centers such as Rostock and Stralsund, local women networks offer a broad range of activities from ad hoc counseling to long-term training programs (table 3.3), while regional groups of national networks such as 'Schöne Aussichten', which aims at women entrepreneurs in the free professions, concentrate on public relations and coaching. Additionally and partly in collaboration with the women networks, university initiatives provide comprehensive services for university graduates interested in setting up their own business.

Table 3.3: Interactions between organizations promoting women entrepreneurship in the State of Mecklenburg Western Pomerania

Collaboration amongst different types of actors	Topics of cooperation
Women networks with (semi-)public organizations (equality opportunity officers, entrepreneurship and regional development agencies)	Individual support for women entrepreneurs (informal, ad hoc)
	Public events and network meetings
Women networks amongst each other and with RC's*	(sponsored) programs for training, coaching, counseling
Women network, RC's, (semi-)public organizations with (women) entrepreneurship initiatives at universities (of applied science)	Developing infrastructure to support women entrepreneurship
	exchanging new trends in entrepreneurship development**

Source: Welter et al. 2004. * Regional Resource Centers; ** cross-border collaboration, initiatives at/with universities.

This changes when leaving the urban centers. In most medium-sized and small towns women (entrepreneurs) networks do not exist, and where they exist they operate on a small-scale basis. There are some small towns that are notable exceptions, where equal opportunity commissioners offer counseling for women (nascent) entrepreneurs. In order to extend support for women entrepreneurs to remote areas of MWP, five Regional Resource Centers (RC) have been established from 2002 onwards.

With regard to the emergence of women (entrepreneurs) networks and inter-organizational relationships within the region, we can distinguish four phases, which partly overlap (figure 3.1):

During the *first phase*, the women network FIW ('Frauen in die Wirtschaft' – 'Women into Business') was set up in the City of Rostock in 1994, which marked the starting point for the emergence of an institutional 'formal' network structure in MWP (figure 3.1, map I). Women entrepreneurs, who had set up their businesses shortly after the transition to a market economy started in 1990, initiated FIW, drawing on contacts to local authorities, development agencies, and chambers of commerce. Interestingly, these relations partly originated from the socialist period, indicating at the importance of 'trusted' and known linkages in setting up a network. Major sources of such linkages

were the Faculty of Educational Science at the Rostock University as well as the College of Education in Güstrow, a town close to the City of Rostock.

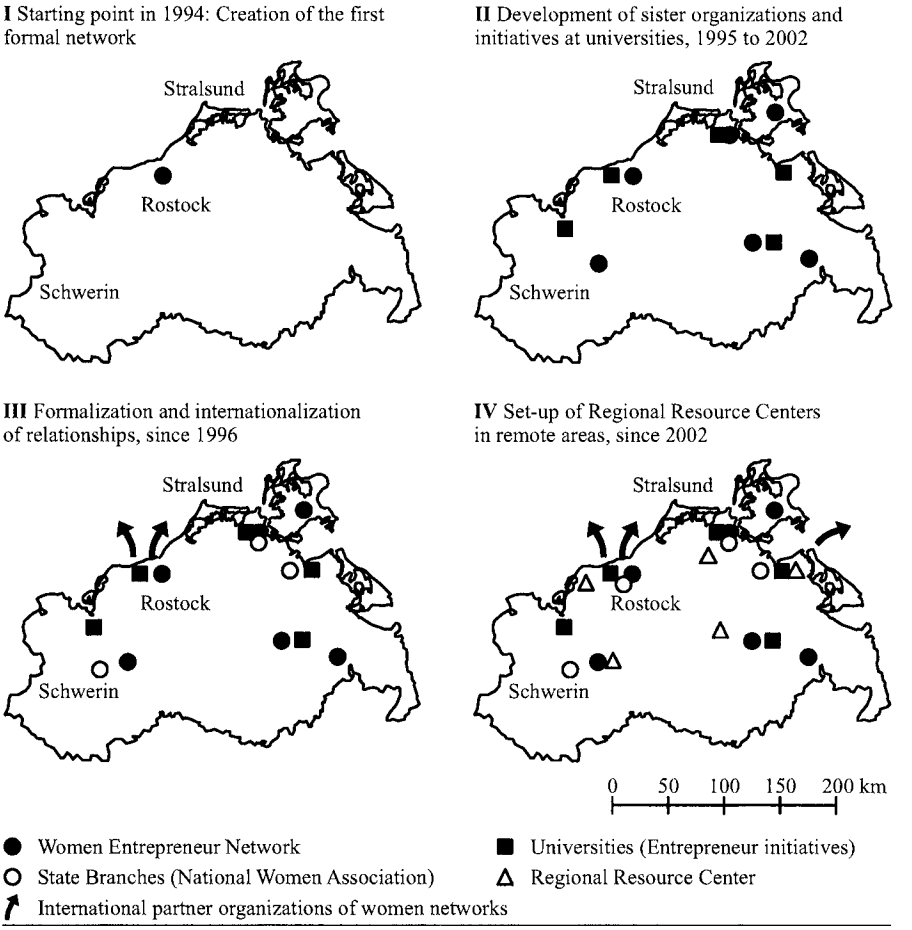

Figure 3.1: Mecklenburg-Western Pomerania: emergence of spatial inter-organizational cooperation

The *second phase*, which lasted from 1995 until 2002, is characterized by two features (figure 3.1, map II). Firstly, promoters from the Rostock FIW network initiated a *systematic spatial extension of network activities* to foster further women entrepreneurship throughout the whole state. FIW-members used their personal contacts to women entrepreneurs in medium-sized and small towns in order to assist them in developing sister organizations. Again, long lasting contacts to local authorities played an important role in getting these organizations off the ground. Moreover, local equal opportunity commissioners became involved as well, indicating a step forward in the quality of network linkages. They either supported the newly originating women net-

works in their area, or they initiated themselves similar networks in their own district, supplementing the overall bottom-up approach of network emergence by a top-down element (one such example is to be found on the Island of Rügen, see figure 3.1, map II).

A second characteristic of this phase concerns the development of entrepreneurship initiatives at the universities, which resulted from an overall growing interest on federal and state level in fostering graduate entrepreneurship. Universities set up special courses to address female students, and they included modules on entrepreneurship into mainstream topics. Examples include the state-wide initiative 'Women in Science and Technology' (initiated on the federal level) or a special course for women in industrial engineering and management. This development served as basis for further collaboration between universities, FIW, and its sister organizations throughout the state.

The *third stage* of network development was again characterized by two processes (figure 3.1, map III). Firstly, three *national (women) entrepreneurs' associations* established branches in the state. The organizations were the Verband Deutscher Unternehmerinnen (VdU – Association of German Women Entrepreneurs), a federal business association of women entrepreneurs in the free professions ('Schöne Aussichten'), and the Association of German Young Entrepreneurs (BJU), which is a mixed-gender network for entrepreneurs under the age of 40.

Moreover, national and local women networks started to cooperate. In the City of Stralsund the regional VDU-group and the local FIW regularly participate in public events about women entrepreneurship at the University of Applied Science. In the state capital Schwerin, the regional group of 'Schöne Aussichten' cooperates with the sister organization of FIW Rostock. This includes organizing public events and network(ing) meetings for business women of the region.

The second process throughout this third stage of network development concerns the *formalization and internationalization of inter-organizational relations*. Inter-organizational relationships went beyond personal and friendly relations, and networks formalized their connections with various public and semi-public authorities in the state. Local women networks began to collaborate with the equal opportunity commissioner of the state MWP and the State Ministry of Labor and Social Affairs. Examples refer to applications for financial support in order to conduct training courses for nascent entrepreneurs and the joint organization of several widely recognized Women Fairs in the state. Moreover, local networks set out to exchange information and knowledge with similar organizations abroad, mainly in the Baltic Sea region, e.g., in Sweden.

This trend led to the *fourth stage* of network development, from 2002 onwards. Modeled on a Swedish example, public and private actors established the above mentioned Regional Resource Centers, with the aim to *foster women entrepreneurship in remote areas* of MWP (figure 3.1, map IV). This

project was designed jointly by FIW Rostock and officers of the state government. FIW Rostock is also responsible for coordinating the RC's activities. The RC's provide services and information for (nascent) women entrepreneurs. They aim at bundling capacities and competencies of different institutions in order to broaden the support offered for women start-ups in peripheral areas. Moreover, their regional managers also try to support new women entrepreneur networks through linking these networks with different public authorities and other local initiatives such as start-up incubators and job centers.

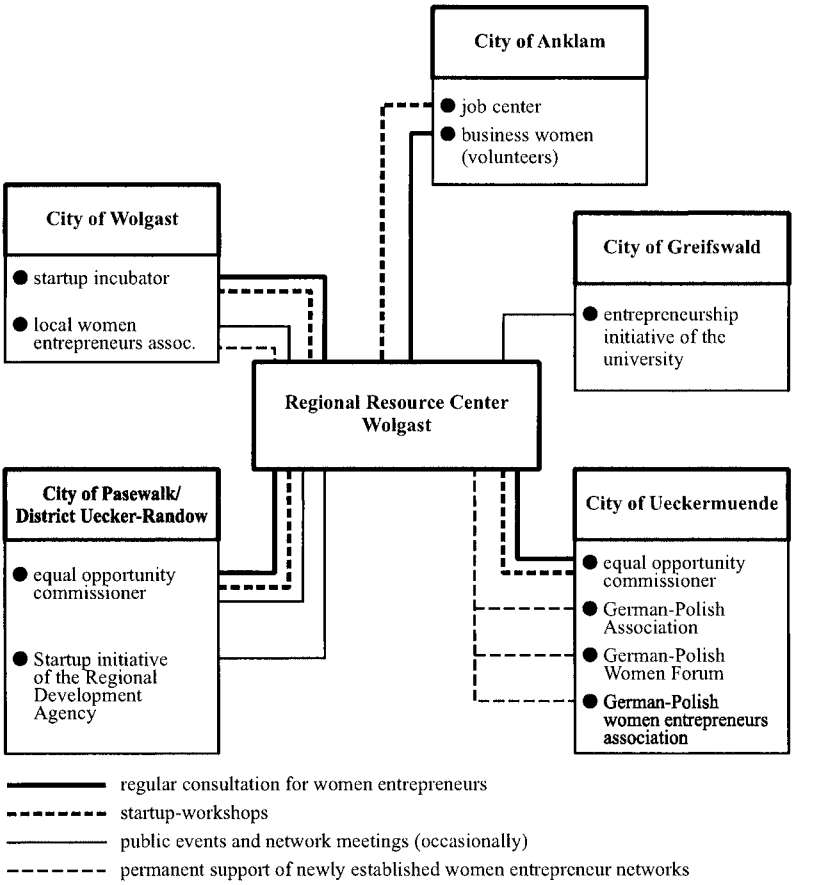

Figure 3.2: Network of Regional Resource Centers in Mecklenburg-Western Pomerania: the example of the rural district Uecker-Randow/Western Pomerania

Figure 3.2 illustrates the range of activities RC's offer and their local embeddedness, based on the example of a RC situated in the Eastern part of MWP, namely in the districts of Uecker-Randow and Western Pomerania. The RC manager regularly visits several small towns in the area, providing consultancy services for women entrepreneurs in cooperation with local pub-

lic and private partners and initiating local round tables. In this regard, RC managers act as high communicators fostering entrepreneurship in remote areas through initiating inter-organizational linkages.

With regard to our conceptual review, the four stages of network development clearly reflect the importance of relationship promoters (Axelsson and Larsson, 2002; Koch et al., 2003) and high communicators (Fromhold-Eisebith, 1995) for the emergence of networks and the development of inter-organizational relationships. Initially, women entrepreneurs played a central role, acting as relationship promoters and using informal contacts to public authorities both to set up their business and to initiate first networks. High communicators appeared in different forms. First of all, this includes equal opportunity commissioners, followed by a later stage also dedicated single municipal officers and the above mentioned RC managers.

Often, the function of relationship promoters and high communicators go hand in hand. In this context, the following example illustrates the important contribution of high communicators and relationship promoters to network development as well as the close interrelation between both functions. In the City of Stralsund, two of the most active women in the local FIW are a woman professor at the local university of applied science, and a municipal officer. The former also supports actively entrepreneurship programs at her university and coordinates state-wide initiatives focusing on female students, while the latter is in charge of business development in the municipal government.

Overall, the strong commitment of high communicators and relationship promoters as well as dense inter-organizational relations can be considered as *strengths* of network development in MWP, all contributing to developing regional conditions, which favor entrepreneurship. *Weaknesses* refer to an overall weak embeddedness of financial institutions into existing networks and supporting structures. Another problem concerns the weak financial basis of the RC's, which rely on temporary funding through EU funds. However, public funding will decline from 2005 onwards, which indicates the challenge for public and private actors to develop strategies for sustaining the RC's and their work in the longer term.

In assessing the process of entrepreneurs' network development in a state similar to MWP, where network development only started once the transition process had begun, one has to account for the short time period private actors had for creating network organizations and inter-organizational linkages.

4.2 Network Development in the City of Munich and its Hinterland

In contrast, women entrepreneurs' networks in West German regions such as the City of Munich could draw on long lasting traditions with regard to fostering gender equality. Similar to the situation in the State of MWP, the support

system for women entrepreneurship in the City of Munich is characterized by a broad range of different actors offering a wide palette of support for women entrepreneurs (table 3.4). Several (semi-)public organizations provide consulting, training, coaching and financing for entrepreneurs, partly with a special emphasis on women in different circumstances (unemployed/after family leave, graduate/non-graduate). Sometimes projects involve actors from different (semi-)public institutions.

Table 3.4: Interactions between organizations promoting women entrepreneurship in Munich

Collaboration amongst different types of actors	Topics of cooperation
(semi-)public organizations amongst each other (incl. support networks)	(sponsored) programs for training, coaching, counseling exchanging new trends in entrepreneurship development*
(semi-)public organizations / support networks and women networks	Regular exchange of information, lobby work; developing gender competences in public authorities; coordinating activities; developing networks in the Munich hinterland
Women networks, partly supported by (semi-) public organizations	Public events, network meetings; counseling and workshops
Women networks amongst each other	Public events, network meetings, lobbying

Source: Welter et al. (2004). * initiatives at/with universities and adult education centers.

Unlike networks in MWP, which regularly offer training courses and counseling activities, thus compensating for a less developed public infrastructure, in Munich women networks mainly concentrate on their 'core competencies', namely the provision of (informal) networking opportunities. Only one network offers additional services such as individual counseling and workshops, which target non-graduate nascent women entrepreneurs. With regard to public relations and lobbying, the respective networks operate jointly, to some extent supported by (semi-)public organizations (table 3.4).

Again, we can distinguish four phases of network evolution and the development of inter-organizational relations (figure 3.3). Contrary to MWP, however, the emergence of networks in Munich and its hinterland is characterized by a different development path. Here, the public support infrastructure and networks emerged (more or less) independent from one another and inter-organizational linkages developed much later.

Moreover, network evolution benefited from a strong tradition with regard to fostering gender equality. Organizations which work for the enforcement of women's position in professional life have a long history in the City of Munich. In 1894, the Association for Women Interests (VfF – 'Verein für Fraueninteressen') was set up as the first center which offered career counseling and a placing service for girls and women. In 1914, together with other

women organizations, most of which had either a catholic, a protestant, or a trade-union background, the VfF created an umbrella organization of Munich women organizations ('Stadtbund Münchner Frauenvereine'). All participating associations aimed at improving the educational and professional opportunities for women in the city.

Phase 1 of network development started in the late 1980s, when the VfF-board decided to initiate a project called 'Frauenbörse' in order to provide a specific counseling program for nascent women entrepreneurs ('New start with 35', figure 3.3, map I). In this context, VfF played a pioneering role by targeting non-graduates who were looking for opportunities to re-enter professional life after a family leave. Female employees of the Munich Adult Education Center (VHS), who had regular and long-standing personal and professional contacts to the 'Stadtbund' and their member organizations such as the VfF, joined in. They arranged workshops, which complemented the program of the VfF-Frauenbörse by specifically targeting graduates. Moreover, both organizations initiated a mutual informal information exchange.

Phase 2 was characterized by the emergence of *new women network organizations*, all of which focused on business women and women entrepreneurs (figure 3.3, map II). Some of them were set up as local groups of a national organization (e.g., 'Connecta' or the Association of Women in Management - FIM) or of international associations such as the 'Business and Professional Women' (BPW) and the 'European Women Management Development Network' (EWMD). Nowadays, one of them operates on a national level, but emerged in Munich (the virtual net 'webgrrls', www.webgrrls.de), while the others started as and remained local associations like the 'Women Business Club' (WBC). This overall network boom gave new impetus to existing organizations as well. For example, the Munich Women Academy (FAM) and the Munich Economic Forum (WMF) were already founded in the mid-1980s, but they gained momentum in their work after 1990.

The emergence of new networks in the 1990s boosted inter-organizational relations, and, thus, contributing to overall institutional thickness in Munich. Networks started to cooperate amongst themselves and with (semi-)public organizations. Beside the VfF-Frauenbörse, four of the new women networks (BPW, FAM, FIM, WMF) became members of the umbrella organization 'Stadtbund Münchner Frauenvereine', using its political connections to foster women's entrepreneurship. According to the regulations of the Munich Municipality, the 'Stadtbund' can send a representative to the Municipal Gender Equality Commission, which consists of women members of the local parliament, women representatives of churches, trade unions, and other important organizations. Although already founded in the mid-1980s, the Commission's work became more important from 1993 onwards, which is partly related to the overall accelerated pace of network development in the early 1990s.

During a *third phase* from 1996 until 1999, (semi-)public organizations started several *initiatives to promote entrepreneurship* in general, picking up

the overall dominating support trend on federal and state level. One example is the 'Munich Entrepreneurship Office' (MEB), a joint initiative of the municipal government and the local chamber of commerce, which offers counseling, seminars, training and coaching. Another example is the 'Office of Entrepreneurship' (BfE), an initiative of the Munich job center which, aims at supporting unemployed persons to re-enter into professional life as a self-employed person (figure 3.3, map III).

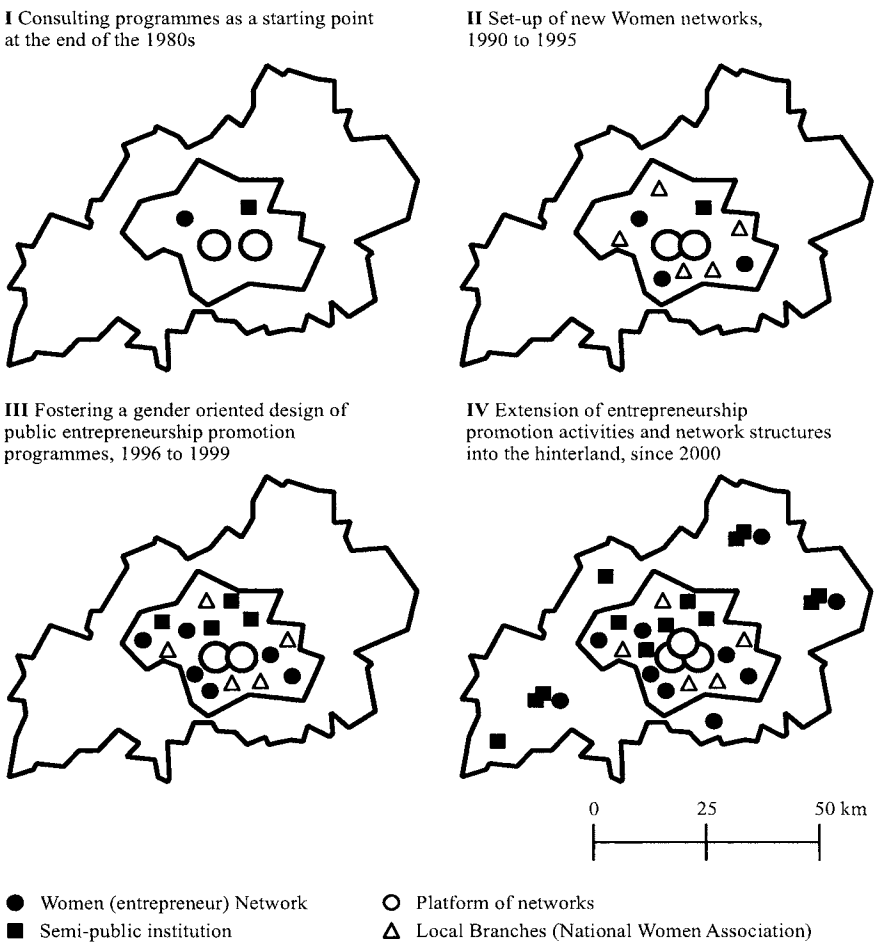

Figure 3.3: Munich and hinterland: emergence of a network structure to support women entrepreneurship

All this boosted inter-organizational relationships, which now began to focus on a *gender-oriented design* of these programs. In this context, women networks, local woman politicians, and the equal opportunity commissioner closely cooperated with each other. One such example concerns the Municipal Gender Equality Commission, which adopted a recommendation address-

ing the municipal parliament with regard to developing gender competence in all public institutions involved in entrepreneurship promotion and the creation of a women start-up incubator.

The present and *fourth phase* is characterized by two processes. Informal *interactions between actors and organizations in the city have been strengthened* through the introduction of a new informal platform, the so-called 'Network Breakfast'. Here, representatives from 10 to 15 networks, which at least partly focus on women entrepreneurship, exchange news and information on a quarterly basis in order to improve their mutual lobbying and public relation work. They also regularly inform (semi-)public institutions about ongoing activities in the city. This enables those involved in counseling new women entrepreneurs to recommend adequate women networks. Moreover, network evolvement now is also initiated top-down. Some of the (semi-)public initiatives have started to stimulate new networks amongst participants of their training courses, attempting to link those networks with the activities of established network organizations.

Secondly, we can observe a *spatial extension of network activities* into the Munich hinterland, mainly initiated by public actors (figure 3.3, map IV). Until recently and contrary to the remote areas in the state MWP, the hinterland lacked both support structures for women nascent entrepreneurs as well as an established network of voluntary women organizations. Only since the late 1990s, the BfE extended its entrepreneurship programs to the hinterland. Since 2003, the 'EFFEKT-Initiative', which is a cooperation between universities in Munich, the adult education centers of the districts around Munich, and other public institutions, has arranged a series of workshops and counseling services for women graduates who wish to re-enter the labor market after a family break. In its next stage, the EFFEKT-program plans to initiate network meetings of the participants. In contrast to MWP, where women entrepreneurs, assisted by equal opportunity officers, were the driving forces for creating networks in rural areas, the spatial extension in the Munich hinterland can be characterized as 'top-down': Network development first of all is initiated by public actors. So far, none of the women networks operating in the City of Munich has created a sister network in the hinterland.

Comparable to the state MWP, temporary public funding by the European Social Fund and the Bavarian state government supports the recent steps to spatially extend network activities into suburbs and less urbanized districts in the wider hinterland of Munich. While temporary funding may become a major problem in developing sustainable networks, the top-down approach used to create new networks in the hinterland of Munich might add to this. This approach resembles the external-internal strategy which Human and Provan (2000) assessed as less successful for network development, as this apparently impedes the creation of a strong voluntary network identity, which however is needed in order to sustain networks over time.

To sum up, the *inter-organizational relationships* in the City of Munich can be characterized as a heterogeneous set of very intensive formal and informal relations. The long lasting tradition of cooperation and self-coordination of Munich women organizations, going back to the 19th and early 20th century, allowed for a quick embedding of new women (entrepreneur) associations. Again, network development and the development of thick inter-organizational linkages profited from the commitment of individual persons, thus, once more confirming the importance of personal factors in the development of an institutional infrastructure for entrepreneurship. In Munich, women in key public positions, who were both responsible for supporting entrepreneurship, and simultaneously engaged in women organizations, acted as process promoters. For example, at the Munich Local Job Center (BfE) a chief executive responsible for entrepreneurship programs regularly arranges lectures on self employment, and she also initiated a counseling service for women nascent entrepreneurs at the above mentioned Munich Women Academy (FAM). This again illustrates the important role high communicators can play in boosting regional activities to support women entrepreneurs.

5. Conclusions and Implications

In analyzing and comparing networks in two different regional settings, i.e., in the City of Munich and in urban centers of the rural State of Mecklenburg-Western Pomerania, we have set out to analyze the factors influencing the emergence and spatial embeddedness of different kinds of (support) networks. From a spatially based perspective, our paper contributes to the understanding of how a regional institutional infrastructure, which aims at fostering regional enterprise development, evolves and which role the path dependence plays in the formation of network interrelationships. Both regional case studies demonstrate the important contribution of *personal factors* such as high communicators, i.e., actors in central public positions, as well as relationship and process promoters within the networks play for the emergence and development of networks and inter-organizational contacts. With regard to *spatial success factors for network development*, we suggest that in both case study regions women entrepreneurship networks are central for securing a constant exchange of regional information both for their participants and public institutions involved in supporting women entrepreneurs.

Furthermore, we could illustrate that *pathways of network and interrelationship emergence* show several similarities, but also a few interesting differences. In the East German State of Mecklenburg-Western Pomerania networks evolved through a 'bottom-up' approach: Women entrepreneurs were the main driving force for network development. As the transformation process in East Germany also included rebuilding institutions and government structures, public administrations saw this as their main task in the early

1990s. Only in later phases of network development, public actors on local and state level took more and more responsibility for fostering inter-organizational relations in remote mid-sized and small towns.

This bottom-up approach to network development goes hand in hand with an internal-external strategy of network emergence, as outlined by Human and Provan (2000). Networks initially focused on building up internal legitimacy before orientating themselves towards external stakeholders, which Human and Provan (2000) identified as a more successful strategy for network emergence. Moreover, women entrepreneurs and high communicators in public organizations were able to draw on known relationships.

Compared to Munich, network development in MWP happened within a relatively short time period. This apparently was facilitated by the strong commitment of various private and public actors. Moreover, common experiences from the socialist period also played a role, as network initiators and promoters were able to draw on trusted and known persons and 'old' linkages. During our interviews, respondents regularly emphasized their 'socialist background', which helped them in knowing who to contact in order to solve problems, where to get access resources and support for their network etc. While this kind of behavior ('blat', cf. Ledeneva 1998) was a necessary response to the constant shortage of materials and consumer goods in the socialist period, its functioning was extended to the transition period. In MWP, this obviously helped to build a formal network structure in a relatively short period of time, as it facilitated identity creation in networks and amongst women (entrepreneurs) during the transition process.

In the City of Munich, this regional identity and awareness towards women (entrepreneurs) roots back to the 19th century, when formal cooperation between women organizations and public institutions began. Therefore, when public institutions started to promote women entrepreneurs, this was institutionally accepted and embedded. Moreover, this helped those networks of women entrepreneurs, which emerged during the 1990s. These network organizations could rely on long-established political mechanisms in order to foster gender-oriented support measures for entrepreneurs in the municipality.

Main differences in network emergence occur with regard to the spatial extension of networks into less urbanized regions. In both case study regions, this spatial extension was a planned activity. While in MWP both entrepreneurs' networks and public administrations worked together in extending their activities into rural areas, this differed in the Munich region. Here, we can observe a 'top-down' approach: (Semi-)public institutions initiated the spatial extension of network activities into the less urbanized Munich hinterland, attempting to create new networks of women entrepreneurs, while most women networks are less interested in extending their activities. In terms of suitable strategies for network development, this questions the longer term survival and sustainability of these new networks. Network legitimacy and network identities, which are important requirements for building a successful net-

work, depend on whether members commit and identify themselves with 'their' network. However, our case evidence for the hinterland of Munich indicates that those networks initiated 'top-down' by public actors appear to have serious difficulties in developing a joint network identity.

Moreover, in the case of both the remote areas in MWP and the Munich hinterland, foreseeable financial difficulties might add to this. Presently, relevant efforts of spatial extension in both case study regions are largely based on temporary project funds from public (sometimes European) sources, which will be decreasing from 2005 onwards. While private sponsoring might be an option, especially in Munich, an increase in private funding conflicts with the oftentimes weak resource base of young and new firms. With regard to implications for policy makers and those involved in fostering regional entrepreneurship development, this indicates a need to develop strategies for setting up and running a network infrastructure outside big urban centers also in a financially sustainable manner.

In both sample areas (semi-)public organizations follow principles that previous studies already identified as key factors for a successful regional milieu for fostering innovation and (women) entrepreneurship: They use competencies and experiences of local entrepreneur organizations in order to design or modify entrepreneurship support measures. They support interrelations between women networks and educational institutions for the purpose of collective learning, and they provide funds for the extension of networking activities into less urbanized regions.

On the whole, dense (formalized and informal) inter-organizational and personal contacts of (entrepreneur) organizations appear essential in order to create a regional milieu, which is favorable for (women) entrepreneurship. However, our study also has its limitations, because we cannot analyze the effects entrepreneurs' network activities have on new venture performance. Studies which analyze new venture creation across different regions of Germany, like the Regional Entrepreneurship Monitor (REM) for Germany, demonstrate huge differences in regional start-up rates (Lückgen and Oberschachtsiek 2004). For example, in 2003 the Munich region had a rate of nascent entrepreneurs twice as high as the one in the City of Rostock and its wider hinterland. Moreover, the current REM study points out remarkable regional differences in venture survival rates. Compared to the Rostock region, urban agglomerations like Munich and Cologne apparently provide a more favorable business environment for new start-ups. Interestingly, the REM report for 2004 reveals that the rate of women nascent entrepreneurs in the Munich region slightly exceeds the rate of men, while in the Rostock region the rate of male nascents is three times the women's rate (Lückgen and Oberschachtsiek, 2004, 17).

Thus, we suggest that there are certain positive impacts of network activities on (women) entrepreneurship, but that these differ across regions. This indicates that an operational network structure is important, but it needs to be

complemented by other elements in order to create an entrepreneurial regional climate. Therefore, we recommend that further research work should focus on the emergence *and* on the effects of the entrepreneurial infrastructure on the development of new ventures in a particular territory. In line with Becker and Dietz (2002, 260) we admit, that the analysis of localized interrelations between the network infrastructure, authorities, and the performance of established firms and young entrepreneurs deserves a comprehensive and longitudinal research design, which combines adequate quantitative and qualitative research methods.

References

Aldrich H., Reese P.R., Dubini P., 1989, Women on the verge of a breakthrough: Networking among entrepreneurs in the United States and Italy. *Entrepreneurship & Regional Development*, 1, 339-56.

Allen W.D., 2000, Social Networks and Self-Employment. *Journal of Socio-Economics*, 29, 487-501.

Amin A., Thrift N., 1994, "Living in the Global." In *Globalization, institutions and regional development in Europe*. Amin A., ed. Oxford: Oxford University Press.

Anderson A.R., Jack S.L., 2003, The articulation of social capital in entrepreneurial networks: a glue or a lubricant? *Entrepreneurship & Regional Development*, 14, 193-210.

Axelsson B., Larsson J., 2002, "Different Network Species as Networking Structures." In *Networks and Business Renewal*, Agndal H., Axelsson, B., eds., JIBS Research Reports, 2002-4. Jönköping: JIBS.

Backes-Gellner U., Demirer G., Sternberg R., 2002, „Individuelle und regionale Einflussfaktoren auf die Gründungsneigung von Hochschülern." In *Unternehmensgründungen: Interdisziplinäre Beiträge zum Entrepreneurship Research,* Schmude J., Leiner R. ed. Heidelberg: Physica.

Bathelt H., 1998, Regionales Wachstum in vernetzten Strukturen: Konzeptioneller Überblick und kritische Bewertung des Phänomens 'Drittes Italien'. *Die Erde*, 129 (3), 247-71.

Becker W., Dietz J., 2002, „Unternehmensgründungen, etablierte Unternehmen und Innovationsnetzwerke." In *Unternehmensgründungen: Interdisziplinäre Beiträge zum Entrepreneurship Research,* Schmude J., Leiner R. ed. Heidelberg: Physica.

Birley S., Cromie S., Myers A., 1991, Entrepreneurial Networks: Their Emergence in Ireland and Overseas. International Small Business Journal, 9, 56-74.

Brüderl J., Preisendörfer P., 1998, Network Support and the Success of Newly Founded Businesses. *Small Business Economics*, 10, 213-25.

Buhmann M., Koch A., Steffensen B., 2002, „Risiken und Strategien zur Risikominderung im Gründungsprozess." In *Unternehmensgründungen: Interdisziplinäre Beiträge zum Entrepreneurship Research,* Schmude J., Leiner R. ed. Heidelberg: Physica.

Butler J. E., Hansen G.S., 1991, Network evolution, entrepreneurial success and regional development. *Entrepreneurship & Regional Development*, 3, 1-16.

Camagni R., 1991, "Local 'milieu', uncertainty and innovation networks: towards a new dynamic theory of economic space." In *Innovation networks: spatial perspectives,* GREMI - Groupe de Recherche Européen sur les Milieux Innovateurs, ed. London: Belhaven Press.

Camagni R., 1995, "Global network and local milieu: towards a theory of economic space." In *The industrial enterprise and its environment: spatial perspectives,* Conti S., ed. Aldershot: Avebury.

Caputo R.K., Dolinsky A., 1998, Women's Choice to Pursue Self-Employment: The Role of Financial and Human Capital of Household Members. *Journal of Small Business Management*, 36 (3), 8-17.

Carter S., Anderson S., Shaw E., 2001, *Women's Business Ownership: A Review of the Academic, Popular and Internet Literature.* Report to the Small Business Service. Glasgow.

Chell E., Baines S., 1998, Networking, Entrepreneurship and Microbusiness Behaviour. *Entrepreneurship & Regional Development*, 12, 195-215.

Curran J., Blackburn, R.A., 1994, *Small Firms and Local Economic Networks: The Death of the Local Economy?* London: Chapman.

Curran J., Blackburn R.A., Kitching J., 1995, *Small Businesses, Networking and Networks: A Literature Review, Policy Survey and Research Agenda*, Small Business Research Centre, Kingston University, Kingston upon Thames.

Deakins D., Philpott T., 1995, Networking by External Support Agencies and Financial Institutions. *International Small Business Journal*, 13 (2), 47-58.

Döbler T., 1998, *Frauen als Unternehmerinnen. Erfolgspotentiale weiblicher Selbständiger.* Wiesbaden: DUV.

Dodd S. D., Patra E., 2002. National differences in entrepreneurial networking. *Entrepreneurship & Regional Development*, 14, 117-34.

FGB – MWP, 2000, Frauen- und Gleichstellungsbeauftragte des Landes Mecklenburg-Vorpommern. *Zur Situation von Existenzgründerinnen und Unternehmerinnen in Mecklenburg-Vorpommern.* Landesregierung Mecklenburg-Vorpommern. Staatskanzlei. Frauen- und Gleichstellungsbeauftragte (Equal Opportunity Commissioner of the State Mecklenburg-Western Pomerania). Schwerin.

Fromhold-Eisebith M., 1995, Das 'kreative Milieu' als Motor regionalwirtschaftlicher Entwicklung. Forschungstrends und Erfassungsmöglichkeiten. *Geographische Zeitschrift*, 83 (1), 30-47.

Fürst D., 2001, "Die 'learning region' – Strategisches Konzept oder Artefakt?" In *Ordnungspolitik als konstruktive Antwort auf wirtschaftspolitische Herausforderungen,* Eckey H-F., Hecht D., Junkernheinrich M., Karl H., Werbeck N., Wink R., eds. Stuttgart: Lucius & Lucius.

Grabher G., 1993, "Rediscovering the social in the economics of interfirm relations" In *The Embedded Firm,* Grabher G., ed. London, New York: Routledge.

Große U., Hartmann F., Voß R., Brandt M., 2002, *Innovative Gründerförderung in Regionen.* Lohmar, Köln: Josef Eul Verlag.

Havnes P.-A., Senneseth K.,2001, A Panel Study of Firm Growth among SMEs in Networks. *Small Business Economics*, 16, 293-302.

Hoang, H., Antoncic, B., 2003, Network-based research in entrepreneurship: A critical review. *Journal of Business Venturing*, 18, 165-87.

Human S.E., Provan K.G., 2000, Legitimacy building in the evolution of small firm multilateral networks: A Comparative Study of Success and Demise. *Administrative Science Quarterly*, 45 (2), 327-65.

Jenssen J.I., 2001, Social Networks, Resources and Entrepreneurship. Entreprencurship and Innovation, (June), 103-9.

Katz J.A., Williams P.M. Gender, 1997, self-employment and weak-tie networking through formal organizations. *Entrepreneurship & Regional Development*, 9, 183-97.

Koch L., 2003, "Zwischen politischer Mode und ökonomischer Methode: Zur Logik von Gründungsförderungsnetzwerken." In *Entrepreneurship in Forschung und Lehre: Festschrift für Klaus Anderseck,* Walterscheid K., ed. Frankfurt am Main: Peter Lang.

Koch L., Kautonen T., Grünhagen M., 2003, *Development of New Venture Support Networks and the Role of "Promoters".* Paper to the 43rd European Congress of the Regional Science Association, 27-30 August 2003 in Jyväskylä.

Lechner C., 2003, Dowling M. Firm networks: external relationships as sources for the growth and competitiveness of entrepreneurial firms. *Entrepreneurship & Regional Development*, 15, 1-26.

Ledeneva, A.V., 1998, *Russia's economy of favours: Blat, networking and informal exchange*, Cambridge: Cambridge University Press,.

Lückgen I., Oberschachtsiek D., 2004, *Regionaler Entrepreneurship Monitor (REM II 2003/2004) – Zur Dynamik von Gründungsaktivitäten in Deutschland: Ausmaß und Ursachen.* Universität zu Köln, Universität Lüneburg.

Malecki E.J., 1997, "Entrepreneurs, networks, and economic development: A review on recent research." In *Advances in entrepreneurship, firm emergence, and growth. Vol. 3.,* Katz J.A., ed. London: JAI Press.

Maskell P., Eskelinen H., Hannibalsson I., Malmberg A., Vatne E., 1998, *Competitiveness, Localised Learning and Regional Development: Specialisation and prosperity in small open economies.* London & New York: Routledge.

McManus P.A., 2001, Women's Participation in Self-Employment in Western Industrialized Nations. *International Journal of Sociology*, 31, 70-97.

Neergaard H., 1998, *Networks as Vehicles of Internationalization: Network Relationships and the Internationalisation Process of Small Furniture Manufacturers.* Ph.D.-Dissertation, Department of International Business. The Aarhus School of Business. Aarhus.

Nilsson P., 1997, Business counselling services directed towards female entrepreneurs – some legitimacy dilemmas. *Entrepreneurship & Regional Development*, 9, 239-58.

Porter M.E., 2000, Location, Competition and Economic Development: Local Clusters in a Global Economy. *Economic Development Quarterly*, 14 (1), 15-34.

Price R., 2004, The role of service providers in establishing networked regional business accelerators in Utah. *International Journal of Technology Management*, 27 (5), 465–74.

Renzulli L.A., Aldrich H., Moody J., 1999, *Family Matters: Gender, Networks, and Entrepreneurial Outcomes.* mimeo.

Sarasvathy S., 2003, Dew N. *Effectual Networks: A pre-commitment approach to bridging the gap between opportunism and trust.* Paper presented at the AOM meeting in Seattle. University of Maryland and University of Virginia.

Schmude J., 2001, "Standortwahl und Netzwerke von Unternehmen." In *Gründungsmanagement – Vom erfolgreichen Unternehmensstart zu dauerhaftem Wachstum,* Dowling M., Drumm H-J., eds. Berlin: Springer.

Schutjens V., Stam E., 2003, The Evolution and Nature of Young Firm Networks: A Longitudinal Perspective. *Small Business Economics*, 21, 115-34.

Spannowsky W., Kistenmacher H., Hofmeister A., Marschall-Meyer M., 2002, „Standortbezogene Steuerung von Unternehmensgründungen durch bau-, planungs-, umwelt- und wirtschaftsverwaltungsrechtliche sowie planungsfachliche Rahmenbedingungen." In *Unternehmensgründungen: Interdisziplinäre Beiträge zum Entrepreneurship Research,* Schmude J., Leiner R. ed. Heidelberg: Physica.

Sternberg R., 1995, Innovative Milieus in Frankreich. *Zeitschrift für Wirtschaftsgeographie*, 39, 199-218.

Sternberg R., 2000, "Die Technologie- und Wirtschaftsregion München-Oberbayern im nationalen und internationalen Vergleich." In *Wirtschaftsförderung für Kommunen,* Industrie- und Handelskammer für München und Oberbayern, ed. München: 2. IHK-Symposium.

Sternberg R., 2003, (ed.) *Endogene Regionalentwicklung durch Existenzgründungen? Empirische Befunde aus Nordrhein-Westfalen.* Akademie für Raumforschung und Landesplanung: Hannover.

Sternberg R., Tamásy C., 1999, Munich as Germany's No.1 High Technology Region: Empirical Evidence, Theoretical Explanations and the Role of Small Firm / Large Firm Relationships. *Regional Studies,* 33 (4), 367–77.

Weiss W., 1996, (ed.) *Perthes - Länderprofile: Mecklenburg-Vorpommern.* Gotha: Klett-Perthes.

Welter F., Ammon U., Trettin L., 2004, *Netzwerke und Gründungen von Frauen.* Berlin: Duncker & Humblot, RWI : Schriften, Heft 76.

4 WHAT CHARACTERIZES SUCCESSFUL START-UP COHORTS ?

Antje Weyh

1. Introduction*

Much is expected from newly founded firms. They should advance structural economic change, create new jobs, and promote innovations. However, it was often shown that many of the newly founded firms do not survive long. To track cohorts of newly founded firms over time is an important way for assessing the long run effects of new businesses. Because these long run effects may differ considerably over time as well as across industries and regions, these dimensions should be taken into account in such an analysis.

Start-ups constitute a market entry and, thus, a substantial element of the market process. There are three effects which should be considered in regards to the relationship between start-ups and economic development (Fritsch and Mueller, 2004; Fritsch, Mueller and Weyh, 2005). Firstly, there is a direct effect which is the growth of a start-up itself. Secondly, a crowding-out-effect may occur which leads to the exit of incumbent firms as well as of newly founded businesses, which do not survive competition. Thirdly, there can be an improvement of supply-side conditions and of competitiveness. This paper deals with the first of the three effects, the development of new businesses, and the factors that influence their success. Data from the establishment file of the German Social Insurance Statistics are used, which provide information about all start-ups and their development for West Germany for the time period of 1984 – 2002. With this database, start-ups in 326 districts (regions) of West Germany and 52 industries can be observed over a period of 18 years.[1]

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* I am indebted to Udo Brixy, Michael Fritsch, Marcus Kunz and Anne Otto for helpful comments on earlier versions.

1 Establishments which are set up without any employees are not included because the database only records establishments with one employee who is subject to obligatory social insurance other than the founder. For this reason, some of the start-ups may be identified too late in the database. For a description of how start-ups are identified in the Social Insurance Statistics and an assessment of the quality of the data see Brixy and Fritsch (2002) and Fritsch and Brixy (2004).

The paper is organized as follows: Section 2 provides a review of theoretical concepts and the empirical evidence attained so far. Survival rates, hazard rates, and the employment development of start-up cohorts of the sample are reported in section 3. The main results of multidimensional analysis of the success of start-up cohorts are discussed in section 4. Section 5 concludes the paper.

2. Organizational Ecology and Review of the Evidence

Empirical studies have shown that new firms are characterized by a relatively high risk of failure during their first years of existence. This so-called *liability of newness* is one of several concepts of organizational ecology for explaining the development of organizations[2]. The liability of newness suggests that emerging firms are more likely to exit the market than older ones. The main reason for this inability to survive competition may be caused by the difficultly of setting up relationships to customers and suppliers and to acquire financial resources as well as personnel. Hence, new firms may fail because of problems that they have in learning their roles as social actors and in the coordination with other actors (Stinchcombe, 1965). With increasing age firms learn how to operate the business and fewer mistakes occur (Woywode, 1998, 41). The results of empirical studies on survival chances of new businesses are, however, somewhat ambiguous. While some studies confirm a liability of newness (e.g.: Bates, 1985; 1990; Churchill, 1955; Hannan and Freeman, 1989; Fritsch and Weyh, 2004; Fritsch, Brixy and Falck, 2004), others attribute middle-aged businesses with the highest mortality rate (e.g.: Fichman and Levinthal, 1991; Audretsch, 1995; Wagner, 1994), and some claim a relatively high mortality rate for older firms (e.g.: Aldrich and Auster, 1986; Bruederl and Schuessler, 1990).

A non-monotonous relation between age and the probability of survival is referred to as *liability of adolescence*. According to this hypothesis, the probability of failure is relatively low shortly after founding but then increases and after some time decreases again. The relatively low failure rate directly after start-up is explained by a kind of a 'honeymoon period' of newly founded businesses due to a certain 'leap of faith' from their environment (Fichman and Levinthal, 1991). Furthermore, the new businesses have an initial inventory of resources available, that may be exhausted before the necessity of a closure threatens them (Bruederl and Schuessler, 1990). However, after this initial time period, the concept of a liability of newness applies.

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2 The classical form of the organizational ecology concept assumes that new organizations have specific organizational characteristics, which due to affiliation to a population or an industry. Because of the phenomenon of organizational inertia, a change of the characteristics which were acquired in setting-up the business, would be related with an increased risk of failure (Hannan and Freeman, 1977; 1984).

The concepts of a liability of newness and a liability of adolescence suggest a decreasing risk of failure for older incumbent organizations. However, the organizational inertia can also lead to an increasing risk of failure as firms mature. This phenomenon is denoted as the *liability of aging* (Carroll, 1987, 40; Aldrich and Auster, 1986; Bruederl and Schuessler, 1990). The basic requirement that the firms are able to react to changes in environmental conditions may be threatened, if certain established routines are left unchanged. Thus, if the firms do not adapt to new technologies and changing market conditions, the risk of failure may increase with age (Baum and Mezias, 1992). Such a *liability of obsolescence* might be one explanation for the liability of aging. A second explanation could be labeled the *liability of senescence* (Woywode, 1998, 43). It denotes the danger of failure due to a 'sclerosis' of unchanged routines, rules, and organizational structures even if the environmental conditions remain rather constant (Barron, West and Hannan, 1993).

A concept which is closely associated with the liability of newness is the *liability of smallness*. The liability of smallness concerns the relation between firm size at the time of establishment and the probability of survival. According to this hypothesis, small firms possess a lower probability of survival than larger firms of the same age. Several empirical studies confirm the relevance of such a liability of smallness.[3]

Studies that investigate the development of employment in start-up cohorts as a measure of success are rather rare. Wagner (1994) analyzed the post-entry performance of new firms in German manufacturing industries between 1979 and 1982. He found a high risk of failure for entrants, which are reflected in relatively high hazard rates in the first years and a decreased hazard rate afterwards. In this study the deterioration of employment due to exiting firms is compensated by a growing employment in surviving firms. Boeri and Cramer (1992) showed that the number of employees in start-up cohorts first increases. Peaking approximately one year after the entry, the employment gradually declines and stabilizes between 90 and 100 percent of the initial cohort employment. According to this study, nearly 50 percent of the new businesses did not survive the first five years.

Brixy and Grotz (2004), using the same database as Boeri and Cramer (1992) for a different period of time showed higher survival rates for East Germany in the early phase of the transformation process than for West Germany. Not only were the survival rates in the East German cohorts higher in this period, but also the development of the number of employees increased tremendously. The results for West Germany correlate with the findings from Boeri and Cramer's (1992) analysis. Fritsch (2004) could show that in the 1990s each new yearly entry cohort in East Germany had a lower survival rate

3 See e.g. Audretsch and Mahmood (1995) and Mahmood (1992, 2000) for the USA, Dunne and Hughes (1994) for the UK, Bruederl and Mahmood (1996) as well as Wagner (1994) for Germany.

and employment growth than its predecessor, while in the West German cohorts the opposite pattern could be observed, i.e. younger West German cohorts tend to have higher survival rates and more employment than the entries of the previous year. The pattern found for East German cohorts can be explained by an increase of market density during the transformation to a market economy. In general, the analysis demonstrates the importance of regional characteristics and time for the development of entry cohorts.

Fritsch and Weyh (2004) analyzed cohorts of newly established businesses in West Germany over a time period of about 18 years. They found that only a few of the new firms grow and generate a significant number of jobs.[4] In all private sector industries, the employment first grows above the initial level. A peaking of the employment in the first year is then followed by a decline. After eight years employment falls under the initial level. While a similar curve progression was found for start-ups in the service sector, the curve for manufacturing remains above the initial employment level for all of the 18 cohorts analyzed. Obviously, the sector also plays a role for survival and growth of newly founded businesses.

3. Descriptive Analysis

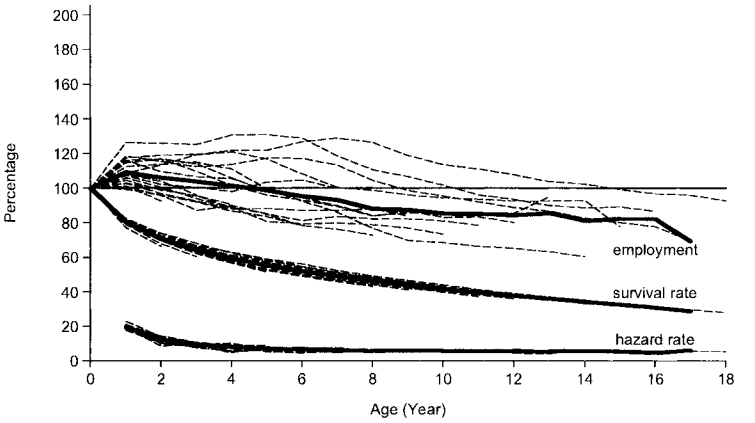
This section analyzes the effect of industry, region and time on the employment development[5], the survival rate[6], and the hazard rate[7] of start-up cohorts. In order to analyze the impact of regional characteristics, the 326 districts of West Germany were divided into three different types of regions: agglomeration, moderately congested regions, and rural areas. The 52 industries were aggregated into two sectors: manufacturing (figure 4.1) and services (figure 4.2).

4 After 18 years, the largest one percent of initial start-ups account for nearly 44 percent of employment. The largest 25 percent have 100 percent of cohort employment.

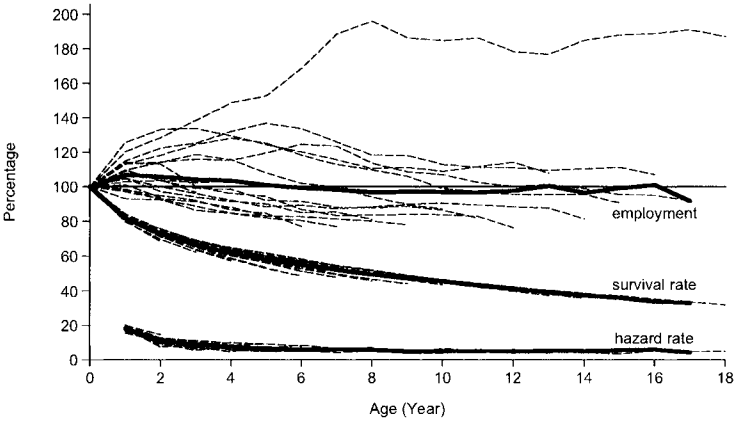
5 In order to compare the pattern of the employment development between cohorts, the number of employees is expressed as an index with initial employment, i.e. the number of employees in the year in which the firm has been set up, set at 100 percent.

6 The survival rate is the share of firms which were established in a certain year and survived the respective observation period.

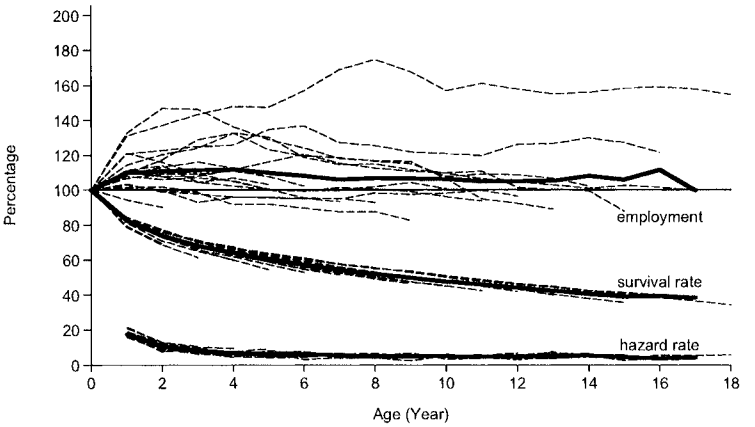
7 The hazard rate is the share of businesses that were closed in a year *t* under the prerequisite that they have survived until t-1.



agglomerations



moderately congested regions



rural areas

Figure 4.1: Evolution of employment, survival rates, and hazard rates in manufacturing

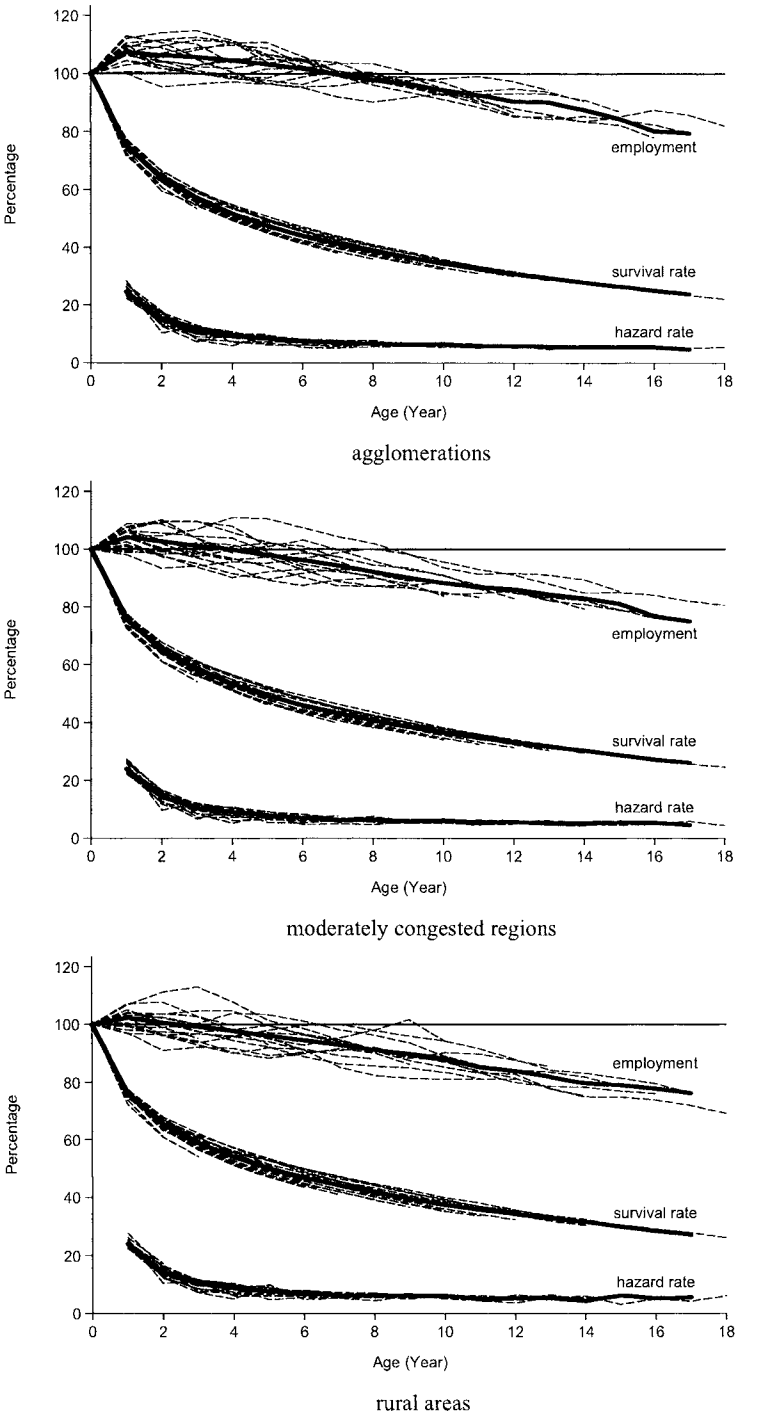


Figure 4.2: Evolution of employment, survival rates, and hazard rates in services

For the start-up cohorts in manufacturing, large differences can be found between the three types of regions. In the agglomerations, the hazard rate is slightly higher than in moderately congested and rural areas., A liability of newness can be observed for all three types of regions.[8] After a relatively strong decline in the first five years, the hazard rate remains at a constant level of six percent in agglomerations and moderately congested regions and approximately five percent in rural areas. The highest five year survival rate is found in rural areas. It is about two percentage-points higher than in agglomerations and moderately congested regions. While the differences between the cohorts are small for the hazard rate and the survival rate, they are relatively high for employment. The average employment in rural areas remains positive for 18 years. For moderately congested regions, the average employment is in each year at nearly 100 percent of the initial level. After four years, the employment of cohorts in the agglomerations falls below the initial level and declines monotonically.

Table 4.1: Survival rates, hazard rates, and employment development in manufacturing and different region classifications (West Germany 1984 – 2002)

Years after start-up	Manufacturing								
	Agglomerations			Moderately congested regions			Rural areas		
	Survival rate	Hazard rate	Employment development	Survival rate	Hazard rate	Employment development	Survival rate	Hazard rate	Employment development
0	100	.	100	100	.	100	100	.	100
5	55.37	7.03	98.82	58.04	6.54	100.90	60.39	6.11	109.92
10	41.71	5.81	85.44	45.39	5.16	96.88	47.69	4.87	106.15
15	32.49	5.42	82.42	36.01	5.51	99.06	39.11	4.39	105.81

The picture for the start-up cohorts in the service sector is quite different from what is found in manufacturing. In the first five years after being set up the hazard rate of newly founded service firms is marginally higher than in manufacturing. The hazard rate remains at a level of about six percent for the first five years. This pattern clearly confirms the liability of newness hypothesis. The lowest survival rate after five years as well as at the end of the observation period is found for the agglomeration. Firm survival is considerably higher in manufacturing than in services for all three types of regions. Employment in moderately congested and rural areas is lower than in the agglomerations. However, pronounced differences in the development pattern of

8 Because of the extraordinary development of the 1984 cohort (especially for moderately congested and rural areas), this year was excluded in the calculation of the average employment over the observation period.

start-up cohorts according to regional type as found for manufacturing cannot be identified. After reaching a maximum in the first year, the employment declines monotonically in all three types of regions. In the agglomeration, it falls under the initial level of 100 percent after seven years, in moderately congested regions this is the case after four years, and in rural areas already after two years.

Table 4.2: Survival rates, hazard rates, and employment development in services and different region classifications (West Germany 1984 – 2002)

Years after start-up	Services								
	Agglomerations			Moderately congested regions			Rural areas		
	Survival rate	Hazard rate	Employment development	Survival rate	Hazard rate	Employment development	Survival rate	Hazard rate	Employment development
0	100	.	100	100	.	100	100	.	100
5	47.57	8.47	103.24	49.24	7.94	98.02	50.14	7.61	96.09
10	34.43	6.56	94.25	36.56	6.16	88.25	37.50	6.01	88.12
15	26.55	5.62	84.54	28.91	5.57	81.21	29.99	6.18	78.99

Table 4.1 and table 4.2 show employment development, survival rates, and hazard rates for manufacturing and services in the three regional categories (agglomerations, moderately congested regions, and rural areas). In all types of regions the survival rate after five, ten and 15 years is the highest in manufacturing. Survival chances of new manufacturing firms are highest in rural areas – perhaps because of lower market density and level of competition (see e.g. Brixy and Kohaut, 1998). The same pattern applies for services; however, the differences of survival rates between rural areas and moderately congested regions are not very high. The lowest hazard rates are found for manufacturing in rural areas. Interestingly, the employment development of start-up cohorts in rural areas remains above the initial 100 percent over the entire observation period. When comparing the employment development of the cohorts in agglomerations, it is remarkable that the cohorts in the service sector always show higher growth. This could be explained by a higher demand for services in densely populated regions allowing the surviving service firms in these regions to grow more than in other regions. All in all, it is apparent that different sectors also develop differently in different regions.

4. Multidimensional Analysis

What are the reasons for the different development of star-up cohorts in different sectors and regions? Which variables are suited to assess the differ-

ences of development? In order to answer these questions an analysis of variance was conducted. Two dependent variables proved to be particularly suitable for measuring the success of start-up cohorts and were included in the multidimensional analysis: survival rate after five years and average firm size of the surviving start-ups after five years. The two variables differ significantly over the three dimensions time (i), industry (j), and region (k). To avoid problems of serial autocorrelation and heteroscedasticity, a Huber-White heteroscedasticity consistent covariance matrix estimator was chosen for the analysis. This method relates each observation to the average value of the industry in the appropriate region and at the same time it controls for the unobserved region-specific and industry-specific effects. Spatial autocorrelation was accounted for by including the average of the residuals of the neighboring districts (regions), as well as, alternatively, the average value of the dependent variable in the neighboring districts (regions) into the model. Table 4.3 gives an overview of the potential determinants of development of start-up cohorts that have been tested and the expected sign of the coefficient.

The start-up rate (business stock approach[9]) and the self-employment rate are indicators for the intensity of competition and for the economic climate for start-ups in the respective industry and region. The number of employees, the share of growing firms, and the average firm size indicate size advantages or disadvantages. The share of persons in the workforce with a university degree stands for qualification structure, and the technological regime represents a measurement for the share of R&D in small firms as compared to larger firms. A positive coefficient for the number of employees as an explanatory variable can be expected because the employees represent a pool of potential entrepreneurs, as well as possibly a size advantage of the respective industry and region (Bruederl, Preisendoerfer and Ziegler, 1996, 118; Mata and Portugal, 1994). The higher the start-up rate in an industry and region is, the more pronounced the competition and the lower the prospects of new firms to be successful will be (MacDonald, 1986; Audretsch, 2001; Sterlacchini, 1994). However, a high start-up rate may also indicate a positive climate for new firm formation activity that is conducive for the success of further start-ups. The same applies for the regional self-employment rate. We expect a positive sign for population density because of a better availability of resources in agglomerations and because of spatial proximity to customers in densely populated regions. For the share of growing firms, as well as for average firm size, a positive relationship with the success of start-up cohorts is to be expected due to possible size advantages. The chances for survival and growth increase when the employees have higher qualifications.

9 See Audretsch and Fritsch (1994) for different approaches of calculating a start-up rate.

Table 4.3: Overview of hypotheses about the effect of different factors on the success of start-up cohorts

Determinants	Success of start-up cohorts
Number of employees in the respective industry and region	+
Start-up-rate	– / +
Population density	+
Self-employment-rate	– /+
Entrepreneurial technological regime	– /+
Share of growing firms in fourth or seventh year	+
Share of employees with a university degree	+
Average firm size after five or eight years	+

Table 4.4: Regression analysis for survival rate, average firm size, and growth rate of employment (West Germany 1984 – 2002)

	Survival rate after five years		Average firm size after five years	
Number (ln) of employees in each industry and region(ijk)	-1.6394** (12.75)	-1.5857** (12.34)	1.8298** (10.85)	1.8351** (10.92)
Start-up-rate (business stock approach) (ijk)	-0.4588** (16.72)	-0.4614** (16.84)	0.4645** (9.42)	0.4664** (9.46)
Population density (ik)	-0.0012** (5.22)	-0.0009** (3.75)	0.0009** (3.57)	0.0009** (3.51)
Self-employment-rate (ik)	0.2024** (5.85)	0.1757** (5.08)	-	-
Entrepreneurial technological regime (ijk)	-0.0562** (2.62)	-0.0584** (2.79)	-	-
Share of growing firms (ijk)	0.2628** (17.29)	0.2431** (15.94)	0.2756** (10.36)	0.2758** (10.24)
Share of employees with an university degree (ijk)	-	-	0.2332** (3.91)	0.2311** (3.90)
Average firm size (ijk)	0.0078** (2.93)	0.0079** (2.95)	-	-
Average residuals in adjacent regions (ijk)	0.4547** (18.53)	-	-0.0409 (1,57)	-
Average of the dependent variable in adjacent regions (ijk)	-	0.5371** (22.82)	-	0.1185** (3.58)
R^2 (overall)	0.0380	0.0408	0.0116	0.0118
F-value	225.13**	265.84**	45.33**	43.16**

i: values per year. j: values per industry. k: values per region. **: statistically significant at the one percent level. *: statistically significant at the five percent level.

Empirical studies show diverging results for the influence of the technological regime on survival and growth (Winter, 1984). The technological regime is measured as the share of R&D employees in small firms divided by the share of R&D employees in all firms representing the importance of small firms in the innovation activity. Two types of technological regimes are usually distinguished: the entrepreneurial technological regime and the routinized technological regime. An entrepreneurial technological regime is a characteristic for early stages of the industry life cycle where no dominant design is established and a high share of the R&D activity is in the small firms. A routinized technological regime characterizes the later stages of the life-cycle. In such a structure, innovation activity of the industry is dominated by the large firms. Literature suggests that in an entrepreneurial technological regime the survival and growth chances of newly founded businesses are smaller (Audretsch, 1995, 65-122). However entry of new firms is easier at such a stage than in a routinized regime (Klepper, 2001; Klepper and Simons, 2000; Suárez and Utterback, 1995).

The results of the estimations are presented in table 4.4. The values of all the explanatory variables relate to the year in which the new businesses have been established. The expected signs for the share of growing firms, as well as for average firm size are confirmed in the model for the survival rate. The higher the number of employees in the respective industry and region, the lower the survival rate is. The number of employees in the respective region and industry has a strong negative influence indicating diseconomies of size. A negative sign is also found for the start-up rate indicating a relatively low likelihood of survival in regions with high levels of new firm formation activity. This may be explained by the pronounced intensity of competition in industries and regions with a high level of start-up activity. Also the negative sign for population density may indicate an effect of relatively high competition in agglomerations. A high self-employment rate has a positive influence on the five-year survival rate, which may be regarded as an effect of a positive start-up climate in an industry and region on the success of newly founded businesses. A negative sign was found for the technological regime measure pointing at a higher risk of failure in an entrepreneurial economic environment.

The estimations for the average size of the surviving new firms after five years confirmed most of the expected relationships. The numbers of employees in the industry and region as well as the start-up rate have a positive impact indicating that the size of the industry in the region and a pronounced entrepreneurial climate is more important for the growth of the surviving start-ups than the relatively high intensity of competition by other new firms. The expected sign for the share of growing new firms and for qualification of the workforce is also confirmed.

In both models, a considerable degree of spatial autocorrelation was found indicating that the success of start-up cohorts in adjacent regions is not inde-

pendent but related in some way. There are two possible explanations for such spatial autocorrelation. Firstly, there may be influences at work which pertain to adjacent regions and which are not fully reflected in the explanatory variables of the model. In order to account for this type of spatial autocorrelation, the average value of the residuals in adjacent regions is included in the model. A second source of spatial autocorrelation may be that the effect of certain determinants of cohort success is not limited to the particular region but also spills over to other regions. Controlling for this type of spatial autocorrelation, the average of the dependent variable in adjacent regions is included. Both types of controls lead to nearly the same results indicating a considerable degree of spatial autocorrelation.

5. Conclusion

The analysis has shown that there are pronounced differences in the development of start-up cohorts across industries and regions. Thus, the direct employment effect of new businesses varies according to the characteristics of the respective industry and region. While it might be more promising for a new manufacturing firm to be located in a rural area than in a high density area, the opposite seems to hold for start-ups in the service sector.

In the multidimensional analysis, a set of variables could be identified that have an impact on the success of a start-up cohort. Especially, it shows that regional characteristics are of great importance for the success of start-ups. The pronounced degree of spatial autocorrelation found also demonstrates the importance of regional factors for the performance of the new firms.

References

Aldrich, Howard and Ellen R. Auster, 1986, Even Dwarfs Started Small: Liabilities of Age and Size and Their Strategic Implications, *Research in Organizational Behaviour*, 8, 165-198.

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

Audretsch, David B., 2001, Research Issues Relating to Structure, Competition and Performance of Small Technology-Based Firms, *Small Business Economics*, 16, 37-51.

Audretsch, David B. and Michael Fritsch, 1994, On the Measurement of Entry Rates, *Empirica*, 21, 105-113.

Audretsch, David B. and Talat Mahmood, 1995, New Firm Survival: New Results Using a Hazard Function, *Review of Economics and Statistics*, 77, 97-103.

Barron, David N., West, Elizabeth and Michael T. Hannan, 1993, A Time to Grow and a Time to Die: Growth and Mortality of Credit Unions in New York City, 1914-1990, Unpublished Working Paper, Stanford University, May, 1993.

Bates, Timothy, 1985, Entrpreneur Human Capital Endowments and Minority Business Viability, *Journal of Human Resources*, 20, 4, 540-559.

Bates, Timothy, 1990, Entrepreneur Human Capital Inputs and Small Business Longevity, *Review of Economics and Statistics*, 72, 4, 551-559.

Baum, Joel AC and Steven J. Mezias, 1992, Localized Competition and Organizational Failure in the Manhattan Hotel Industry, 1898-1990, *Administrative Science Quarterly*, 37, 580-604.

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

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

Brixy, Udo and Michael Fritsch, 2002, Die Betriebsdatei der Beschäftigtenstatistik der Bundesanstalt für Arbeit, in Michael Fritsch and Reinhold Grotz (eds.), *Das Gründungsgeschehen in Deutschland: Darstellung und Vergleich der Datenquellen*, 55-78.

Brixy, Udo and Susanne Kohaut, 1998, Employment growth determinants in new firms in Eastern Germany: Based on a combination of IAB establishment database and IAB establishment panel, *IAB Labour Market Research Topics*, 26, 1-20.

Bruederl, Joseph and Talat Mahmood, 1996, *Small Business Mortality in Germany: A Comparison Between Regions and Sectors,* (Diskussionspapier FS IV 96-20), Berlin: Wissenschaftszentrum Berlin.

Bruederl, Joseph, Peter Preisendoerfer and Rolf Ziegler, 1996, *Der Erfolg neugegründeter Betriebe, eine empirische Studie zu den Chancen und Risiken von Unternehmensgründungen*, Berlin: Duncker and Humblot.

Bruederl, Joseph and Schuessler, 1990, Organizational Mortality: the Liabilities of Newness and Adolescence, *Administrative Science Quarterly*, 35, 3, 530-547.

Carroll, Glenn R., 1987, *Publish and Perish: The Organizational Ecology of Newspaper Industries*, Greenwich, Conn: JAI.

Churchill, Betty C., 1955, Age and Life Expectancy of Business Firms, *Survey of Current Business*, 35, 15-19.

Dunne, Paul and Alan Hughes, 1994, Age, Size, Growth and Survival: UK Companies in the 1980s, *Journal of Industrial Economics*, XLII, 2, 115-140.

Fichman, Mark and Daniel A. Levinthal, 1991, Honeymoons and the Liability of Adolescence: A New Perspective on Duration Dependence in Social and Organizational Relationships, *Academy of Management Review*, 16, 2, 442-468.

Fritsch, Michael, 2004, Entrepreneurship, entry and performance of new business compared in two growth regimes: East and West Germany, *Journal of Evolutionary Economics*, 14, 5 25-542.

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

Fritsch, Michael, Udo Brixy and Oliver Falck, 2004, *The Effect of Industry, Region and Time on New Business Survival – A Multi-Dimensional Analysis*, Working Paper 04/2004, Faculty of Economics and Business Administration, Technical University Bergakademie Freiberg.

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

Fritsch, Michael, Pamela Mueller and Antje Weyh, 2005, Direct and Indirect Effects of New Business Formation on Regional Employment, *Applied Economics Letters*, (forthcoming).

Fritsch, Michael and Antje Weyh, 2004, *How Large are the Direct Employment Effects of New Businesses?: An Empirical Investigation*, Working Paper 05/2004, Faculty of Economics and Business Administration, Technical University Bergakademie Freiberg.

Hannan, Michael T. and John Freeman, 1977, The Population Ecology of Organizations, *American Journal of Sociology*, 82, 929-964.

Hannan, Michael T. and John Freeman, 1984, Structural Inertia and Organizational Change, *American Sociological Review*, 49, 149-164.

Hannan, Michael T. and John Freeman, 1989, *Organizational Ecology*, Cambridge MA: Harvard University Press.

Klepper, Steven, 2001, Employee Startups in High-Tech Industries, *Industrial and Corporate Change*, 10, 639-74.

Klepper, Steven and Kenneth L. Simons, 2000, The Making of an Oligopoly: Firm Survival and Technological Change in the Evolution of the U.S. Tire Industry, *Journal of Political Economy*, 108, 728-760.

MacDonald, James M., 1986, Entry and Exit on the Competitive Fringe, *Southern Economic Journal*, 52, 640-652.

Mahmood, Talat, 1992, Does the Hazard Rate for New Plants Vary Between Low- and High-Tech Industries?, *Small Business Economics*, 4, 201-209.

Mahmood, Talat, 2000, Survival of Newly Founded Businesses: A LOG-Logistic Model Approach, *Small Business Economics*, 14, 223-237.

Mata, José and Pedro Portugal, 1994, Life Duration of New Firms, *Journal of Industrial Economics*, 42, 3, 227-245.

Sterlacchini, Alessandro, 1994, The Birth of New Firms in Italian Manufacturing, *Journal of Industry Studies*, 1, 77-90.

Stinchcombe, Arthur L., 1965, Organizations and Social Structure, in March (eds.): *Handbook of Organizations*, 153-193, Chicago: Rand McNeally.

Suárez, Fernando F. and James M. Utterback, 1995, Dominant designs and the survival of firms, *Strategic Management Journal*, 16, 415-430.

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

Winter, Sidney J., 1984, Schumpeterian Competition in Alternative Technological Regimes, *Journal of Economic Behaviour and Organization*, 5, 287-320.

Woywode, Michael, 1998, *Determinanten der Überlebenswahrscheinlichkeit von Unternehmen, eine empirische Überprüfung organisationstheoretischer und industrieökonomischer Erklärungsansätze*, Baden Baden: Nomos.

5 DIRECT EMPLOYMENT EFFECTS OF NEW FIRMS*

Further Empirical Insights Concerning the Regional and Technological Dimension

Dirk Engel and Georg Metzger

1. Introduction

Recent published studies suggest a positive relationship between new business formation and economic development (Audretsch and Fritsch, 2003; Audretsch and Keilbach, 2004; Fritsch and Mueller, 2004). Regions are, however, heterogeneous units and differ with respect to determinants of growth.[1] These determinants also affect firm formation and firm growth, and one may, therefore, expect remarkable regional differences in the employment contribution of new firms. For example, Brixy and Grotz (2004) show that the cohort employment of Eastern German start-ups increased more than that of Western German start-ups in mature stages. Related to this discussion, particularly firms occupying market niches and entering into formative stages of new industries are seen as driving forces for positive employment effects in the long run. New or better products, processes, and services increase the technological competitiveness of an economy and, hence, its economic growth. Technology orientation and knowledge intensity are major characteristics of firms occupying market niches forcing its performance and survival (see Almus et al., 1999; Almus, 2001; Agarwal and Audretsch, 2001).

Thus far, a descriptive analysis highlighting the regional differences in the employment contributions of new firms on a more disaggregated regional level as well as those in the employment contributions of high-technology

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1 Fritsch (2004), for example, summarizes a number of reasons why growth may differ between regions. Regions may differ with respect to technology regime, industry structure, knowledge, and knowledge flows, ability to cluster industries and much more.

firms has not been performed.[2] In this paper, we address both questions and present new findings with respect to the direct gross employment effect of new firms. In doing so, we offer descriptive results concerning the employment figures of certain cohorts of newly founded firms and their evolution in mature stages. Since we do not account for indirect effects, namely crowding-out effects in incumbents and positive supply-side effects, we only address one major part of new firms' employment effects.

Besides the two unique features of this paper, our results also allow a comparison to the findings of Boeri and Cramer (1992); Brixy and Grotz (2004); Fritsch and Weyh (2004). In contrast to all these studies, we apply the ZEW Entrepreneurship Study as an alternative database to the IAB Establishment Register. The latter database suffers from the limitation that foundations of sole proprietorships, that is, firms without any employee subject to social security contributions, are not included.

The remainder of the paper is presented as follows. In the following section we provide some background information on the topic of employment effects of newly founded firms and derive our expectations regarding the evolution of cohort employment. A short description of the database and some information on data preparation are presented in Section 3. Section 4 contains the results of our empirical analysis. The study concludes with a summary in Section 5.

2. Background

2.1 Employment Effects of New Firms

We start with a systematic look at the employment effects of new firms (see also Fritsch, 1997; Fritsch and Mueller, 2004). The employment effects of a cohort of a newly established firm are aligned with the course of the firm's life cycle. New firms create an initial number of new jobs at their foundation. In the mature stage, the number of jobs generated by new firms depends on their success with respect to sufficient profitability. Insufficient success results in severe consequences, like capacity reduction or market exit – both lead to job losses. These losses might be compensated by the growth of surviving firms. The early-stage growth of new firms is mainly affected by their size at foundation. This stylized fact results from wide empirical evidence seeking to test Gibrat's Law. Gibrat's Law postulates that firm growth is independent of firm size (see Geroski, 1995, for details).

In the mature stage, the employment effect of new firms can be positive or negative. The ultimate sign, thereof, depends on the ability of surviving firms to cull more new employees than other firms release due to its market involvement. The business activities of new firms interfere with the market po-

2 Weyh (2006), also presents empirical evidence concerning the development of cohort employment on a more disaggregated level.

sitions and supply chains of incumbents. Thus, an indirect new-firm employment effect is apparent. On the one hand, new or better products, processes, and services increase the surplus for sub-purchasers heightening their competitiveness and, hence, the employment security and development of existing firms. On the other hand, increasing market pressure hinders the development of competitors, which might result in job losses. Table 5.1 summarizes the main effects of new firms with respect to employment.

Table 5.1: New firms' employment effects

Effect...	...in short term	...in medium term	
...in new firms (direct effect)	Jobs at foundation	Job gains for surviving firms, which then grow	Job losses for poorly performing firms
...on other firms (indirect effect)		Job gains for sub-purchasers and suppliers	Job losses for competitors
Bottom line	Is strictly positive	Possibly positive or negative	

2.2 Empirical Evidence for Germany

In this paper, we emphasize the direct employment effect of new firms in the medium term. We are particularly interested in the employment contributions of new businesses in light of general employment. Boeri and Cramer (1992) present initial results for West Germany for the period from 1977 to 1987. Their results clearly suggest an inverse U-shaped curve of cohort employment evolution over time: cohort employment rose in the first two years and declined thereafter. Their picture emphasizes that cohort employment in mature stages tends to be somewhat lower compared to the initial employment. Brixy and Grotz (2004) focused on employment figures in the 1990s and dealt with East/West-differences in particular. Their findings for Western Germany are mostly in accordance with results of Boeri and Cramer (1992). The recently published study by Fritsch and Weyh (2004) gives some initial insights into long-term cohort employment development. Most remarkably, the cohort employment continuously declines after a period of eight years. The number of individuals employed by a cohort of a new firm reaches about 80 percent of the initial level 18 years after foundation. In summary, the direct employment contribution of new firms is considerable in the long term as well.

2.3 Regional Conditions and their Relevance to Direct Employment Effects

Regional conditions may affect the formation, survival and growth of new businesses. Brixy and Grotz (2004) show the most remarkable regional effect in terms of the comparison of Eastern and Western Germany. By applying an

alternative database, we test the validity of their results. The Eastern German economy was characterized by an (ongoing) transformation process, which has been initiated by "shock treatment" (Brezinski and Fritsch, 1995). The introduction of the Deutsche Mark on July 1, 1990 led to enormous economic pressure on the Eastern German economy. Competitiveness decreased remarkably and existing partners in the formerly communist Eastern Bloc were not willing to pay new prices in hard currency. Due to this, many firms collapsed and released huge portions of the Eastern German workforce. On the other hand, enormous transfers of resources from Western to Eastern Germany preserved a relatively substantial purchasing power. The combination of both instances defined a "start-up window" for entrants into the Eastern German market. The collapsing of firms led to low competition in local markets for non-tradable goods. The lack of infrastructure as well as a backlog in consumption in conjunction with the aforementioned preserved purchasing power offered an ideal opportunity to set up new businesses and realize fast growth. Based on these concepts, we expect that the *overall growth rate of cohort employment of newly founded Eastern German firms is higher than that of Western German firms.*

In addition, we point out regional differences within Eastern as well as Western Germany. In doing so, we expect that the evolution of cohort employment may differ between regions with high population density and those with lower density levels. High-density regions show some advantages with respect to the availability of highly qualified employees, R&D infrastructure, market size, and market heterogeneity. However, these regions are also confronted with some disadvantages; higher local taxes and rent payments as well as narrow physical spaces for firm expansion hamper firm growth in high-density regions. One may expect these regions to be mainly attractive to small-scale firms with low growth perspectives, e.g. R&D-intensive firms in early stages and service-oriented firms. As a result, growth oriented new firms may avoid settling in densely populated regions. Therefore, *regions with moderate or low population density may attract growth-oriented firms to a greater extent and, hence, perform better with respect to the evolution of new firm cohort employment than regions with high population density.*

2.4 Business Characteristics and their Relevance to Direct Employment Effects

We also stress the role of firms occupying market niches and entering into formative stages of new industries. A formative industry life-cycle stage known as the 'entrepreneurial regime' (Winter, 1984) is favorable to the entry of new firms with knowledge-intensive or innovation activities. Trial-and-error processes and high uncertainty (e.g. regarding demand, market acceptance or technological risk) are characteristics which characterize this stage. Experienced value-added processes, minor (expected) profitability of new

business ideas and insufficient flexibility to implement radical changes in the specification of products or within the production process hinder incumbents in playing an active role in the formative stage of a new industry.

A mature industry life-cycle stage is characterized by incremental innovations, high importance of its accumulated stock of knowledge and a 'routinized regime' (Winter, 1984), all of which are necessary to complete the innovation process. It favors activities of incumbents if knowledge and experience are non-transferable. Some business ideas and market niches, however, are inaccessible to incumbents due to their disadvantages in implementing new specifications in their proven production processes. Hence, theories of strategic niches proposed by Porter (1979) and others suggest the simultaneous co-existence of small and large companies – if small firms identify and occupy niches. Along these lines one may expect that the *cohorts of new firms occupying market niches and entering into formative industry life-cycle stages perform better with respect to the evolution of cohort employment than the cohorts of other new firms.*

3. Database, Definitions, and Procedures

We use the ZEW Entrepreneurship Study to derive empirical evidence concerning the employment figures of cohorts of new firms. The database was constructed by the ZEW and the University of Mannheim via a telephone survey in 1999 (see Almus et al., 2001, for details).[3] The survey aimed to acquire information with regard to the annual employment as well as the survival status of firms founded between 1990 and 1993. The ZEW Foundation Panels East and West provided the parent population from which a random sample of 6,000 Eastern German and 6,000 Western German firms was drawn. These panels are based on data allocated by Creditreform, which, as the largest German credit rating agency, maintains a comprehensive database of German firms (Almus et al., 2000). With 3,702 complete interviews[4] out of 12,000 sample observations, the response rate (31 percent) surpasses many other German studies conducted by telephone.[5]

We apply the definition of the German Federal Office for Building and Regional Planning (BBR) to analyze regional differences in the evolution of employment contributions of new firms. In doing so, we differentiate between

3 The questionnaire was part of a project co-funded by the Deutsche Forschungsgemeinschaft (DFG) under the grant LE1147/1-1. Matthias Almus and Susanne Prantl were mainly responsible for organizing the questionnaire, and both published a series of papers based on it.

4 The term "complete interview" refers to a final status of the CATI system. Nevertheless, the individual observations differ in their information content.

5 Several firms refused to answer all of the questions but at least gave information as to whether they had exited the market or not. For analyses dealing with the survival of firms, a statement regarding the survival status is possible for an additional 2,234 firms.

agglomeration regions, moderately congested regions, and rural areas. Firm affiliation is available at the zip code level, and, thus, supports the aggregation of cohorts of new firms according to these three types of regions. Due to our use of firm-level data, each firm's entire employee base is apportioned to the region in which its headquarters is located, regardless of where the employees actually work. Hence, regions that are home to firms with fewer non-resident establishments are represented more accurately.

Related to the second main contribution of the paper, we consider cohorts of knowledge-intensive and technology-intensive firms to approximate the group of firms occupying market niches. In addition, we take into account business formation activities in the information and communication technology (ICT) sector as an example of a new market. The expectations regarding the benefits of applying ICT innovations are still very high and partly confirmed in empirical studies (see, e.g., Bresnahan et al., 2002). Based on this high potential for new ICT applications, an increase in the number of ICT-related firms is evident.

The identification of high-technology firms, knowledge-intensive firms, and firms in the ICT sector is based on the industry-level bearing on the classification of technology-intensive goods derived by the Organisation for Economic Co-operation and Development (OECD) (see Gehrke et al., 1997). Manufacturing industries are divided according to their R&D intensity into 'high-technology industries' and 'other manufacturing'. High-technology industries are considered as having an average R&D intensity of 3.5 percent or higher. Recent empirical studies (see, e.g., Engel and Fier, 2001) show that many firms in the service sector carry out considerable innovation activities as well. Analogously, these service industries are treated as part of the high-technology service sector (see Grupp and Legler, 2000). Finally, we stress the importance of non-technical consulting services (NTCS) characterized by high levels of knowledge intensity. High-technology industries and NTCS form the group of knowledge-intensive firms. Firms in other industries are low-tech as well as low-knowledge-intensive. The cross-section sector 'Information and Communication Technology' is defined according to the OECD (2000) list of applicable industries. Additionally, we include the retail sale of ICT-related products in the ICT sector (see Licht et al., 2002).

Alternatively, we use information about the entrepreneurs in regarding knowledge-intensive firms. In accordance with Landstroem's (1999) definition, we regard an entrepreneur as an individual who takes on full or partial responsibility for the risk of a firm's failure and who is involved in its management. Subsequently, we aggregate individual-level data about each entrepreneur's highest graduate degree at the firm level. We differentiate among firms with at least one academically distinguished founder, those with at least one master craftsman and those with lower 'human capital' inputs.

The parent population includes about 304,000 new Eastern German firms and 474,000 new Western German firms. Our final sample of 1,683 surveyed

firms is a 0.2 percent sample of the parent population. This paper provides representative analysis concerning the cohort development and the share of new firm employment in overall employment. Thus, we make a projection from the sample data to the parent population of newly founded firms. Thus, we weight each firm with the inverse of the firm's drawing probability and subsequently calculate the sum of cohort employment. Each firm's drawing probability is differentiated by firm size, industry, and survival state. These factors are the main determinants of the firm's employment level and, hence, may eliminate the bulk of the potential sample bias.

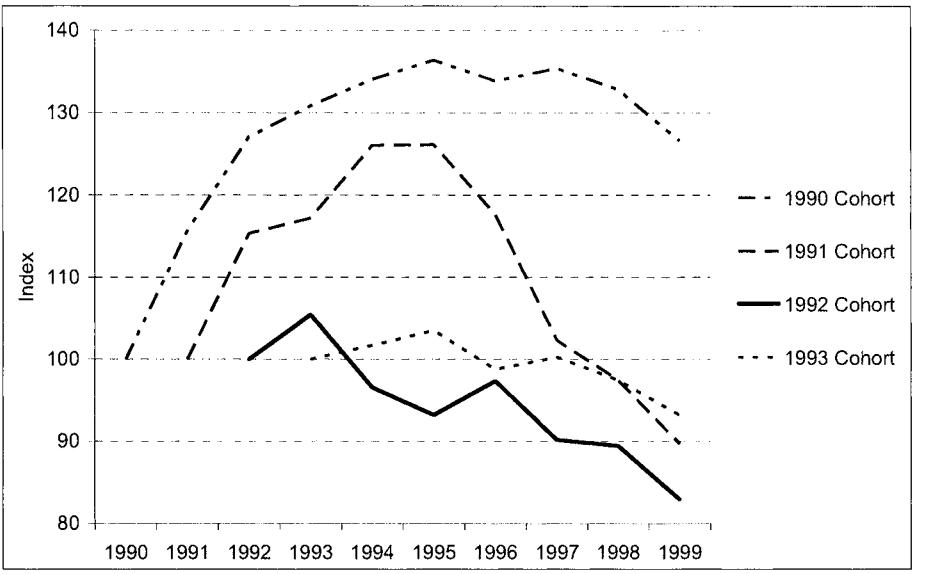
4. Empirical Results

In essence, we focus on a description of cohort employment evolution and present possible explanations for observed figures. Our analyses take the employment contribution of surviving firms into account as well as that of business failures. Of course, our explanations are not sufficient to derive causal relationships. This is mainly due to the fact that we do not control for the impact of other factors – start-up size, for instance – explicitly.

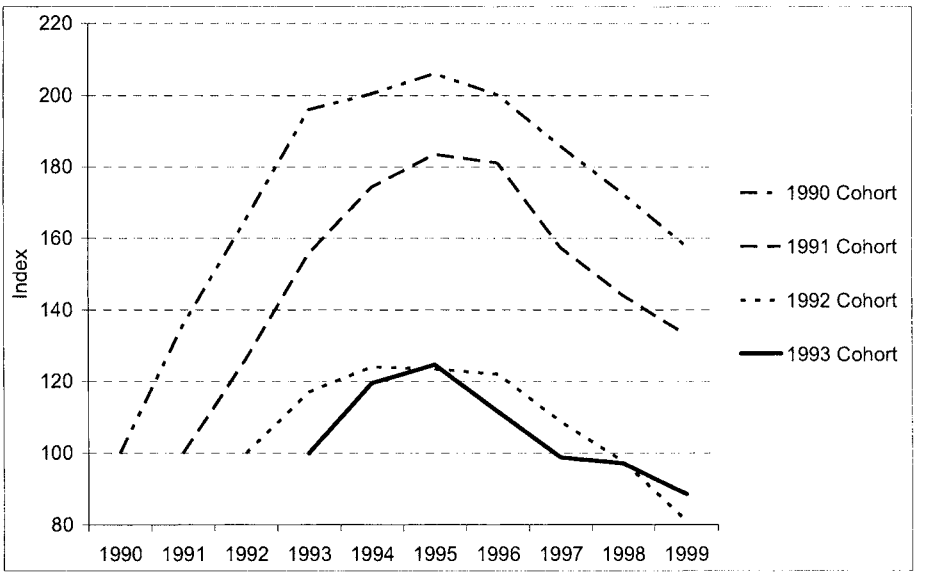
4.1 Cohort Development Between 1990 and 1999

We start with an analysis resembling the study of Brixy and Grotz (2004). In contrast to these authors, we focus on firm-level cohort development, thereby taking sole proprietorships into account. Figure 5.1 shows the employment development of four Western German cohorts of new firms; figure 5.2 does the same for the four Eastern German firms. Since we are focusing on the comparison of developing patterns, we present indices. The number of employees in new firms at the foundation year is, thus, set to the initial index value of 100. The values for the subsequent years are calculated as follows: the employment statistic in year t is divided by that of the foundation year then multiplied by 100.

While, for example, the Eastern German 1990s cohort reaches an index level of 159 points, the Western German cohorts reaches only 133 points at the end of the investigation period in 1999. We observe lower index levels in the year 1999 for the 1991 cohorts. The difference between Eastern and Western German cohorts, however, is still obvious. The superiority of the Eastern German cohorts results from the so-called 'start-up window' that they were able to utilize after the German reunion: the very low firm density and firm productivity, lack of infrastructure, and backlog in consumption seen in the period offered an ideal opportunity for newly founded firms to grow.



Source: ZEW Entrepreneurship Study, authors' own computations.
Figure 5.1: Western German cohort-employment development



Source: ZEW Entrepreneurship Study, authors' own computations.
Figure 5.2: Eastern German cohort-employment development

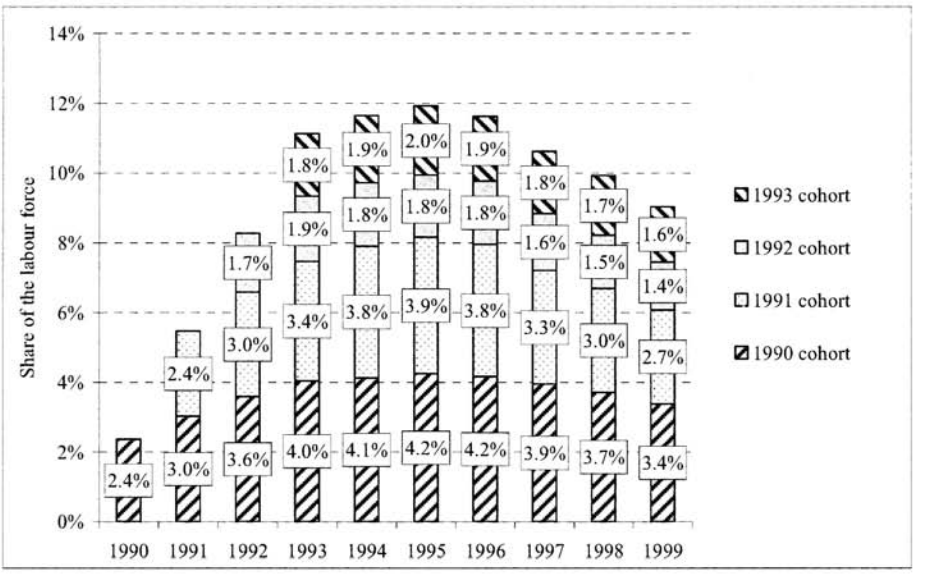
However, the 'start-up window' closed very quickly. Subsequently worse economic conditions led to lower index levels for 1992 and 1993 cohorts of new firms in 1999. This observation is in accordance with the results of Geroski et al. (2002). They show for new Portuguese firms that founding conditions have long-term effects on survival and, as a consequence, on post-

entry performance. Most of the cohort developments take the expected course, but the Western German 1992 and 1993 cohorts do not. Because initial conditions in 1993 were worse than in 1992, the 1993 cohort performed better than that of 1992. However, one might expect – regardless of the economic conditions – any cohort to definitely grow in the first year; for instance, founders tend to start very optimistically, blind to reality to a certain degree. This background facilitates the explanation of the evolvement of the two cohorts in question: after the first year of their existence, the firms of the 1992 cohort were confronted with a declining real GDP in 1993, thus having to draw on their resources to withstand the poor economic situation. The firms founded during 1993 were able to match their initial features with the prevalent conditions. After their first period, they were faced with better conditions and did not need to draw on their resources. As a consequence, they were more capable o exploit the increasing economic activity.

Figure 5.1 and figure 5.2 also show the typical inverted U-shaped, two-phase development of cohort employment. Firstly, employment losses in poorly performing firms (including market exits) are overcompensated for by firms which expand in their first years. This period is very short, and lower maximum index levels are reached if economic conditions are poor. The increase in cohort employment is then followed by a continuous decline in employment until the end of the investigation period. Employment gains if expanding firms cannot compensate for employment losses in poorly performing firms. Cohorts confronted with bad economic conditions fall short of the starting level at the end of the investigation period. This means that, in general, the direct initial employment contribution of new firms is reduced, and, hence, cannot be maintained in the long run. In summary, we observe a very similar development of cohort employment at the firm level, just as Brixy and Grotz (2004) did on the level of establishments with one or more employees making social security payments. The 'start-up window' for Eastern German firms closed very quickly, and the development of cohort employment follows an inverted U-shaped curve.

So far, the figures are merely displaying the development of the cohort employment of each founding cohort. However, relatively little is known about the absolute contribution that newly and recently founded firms make to economy employment. Figure 5.3 presents the shares in the whole labor force, incorporated by the founding cohorts between 1990 and 1999. Beneath the typical inverse U-shaped courses, which are mapped by the quotas of the single cohorts, one can see that more than a few people were wage-earners in young firms. The share of a cohort in the labor force at the year of foundation ranges between 1.7 and 2.4 percent. The share increases in the medium-term for the 1990 and 1991 cohorts, and decreases for the 1992 and 1993 cohorts. In 1993 about 11 percent of the labor force was employed in firms not older than four years. One in nine employees worked in a young firm. From our point of view, the direct employment effect of new firms is remarkable. The economic

conditions in the early 1990s were extraordinarily good and the transformation of the Eastern German economy to a market-oriented economic system was firing on all cylinders. These conditions indicate optimal possibilities for the entry and growth of new firms and hence, the cohort development is not representative of cohorts in the late 1990s.



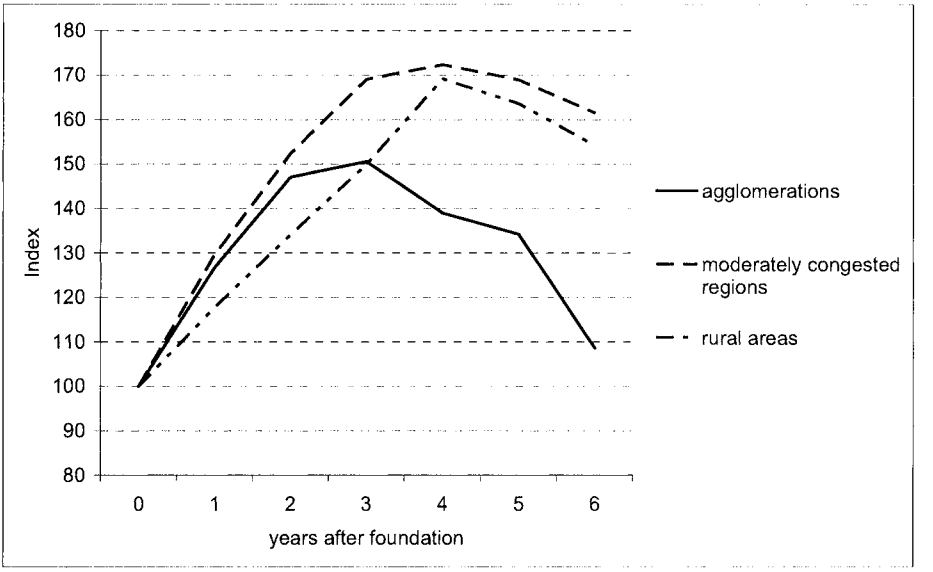
Source: ZEW Entrepreneurship Study, authors' own computations.

Figure 5.3: Cohorts' share-development in created jobs, scaled by labor force

4.2 Regional Pattern of Cohort Development

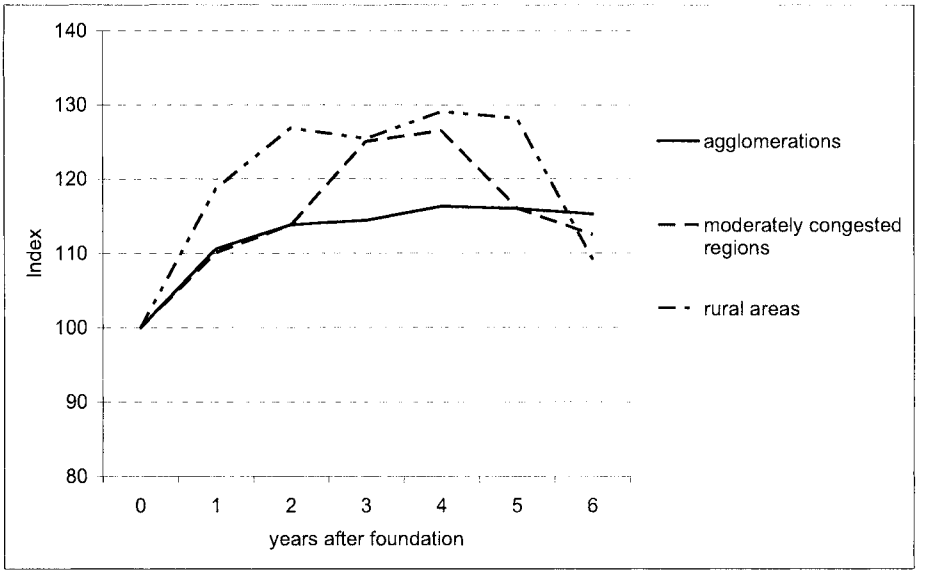
In the following, we distinguish regional differences in the evolution of cohort employment. Due to data restrictions, we are not able to stress regional differences for diverse groups of firms (e.g. by sectors) and are forced to pool the data. Therefore, we present employment figures for all new firms in agglomeration regions, moderately congested regions, and rural areas. In doing so, figure 5.4 shows the results for Eastern Germany and Western Germany. The figures suggest remarkable differences in the evolution of cohort employment between agglomeration regions on the one hand and moderately congested regions as well as rural areas on the other. The number of employees in cohorts of new firms which are located in moderately congested regions or rural areas reaches about 160 percent of initial employment in the sixth year. In contrast, cohort employment in agglomeration regions declines very quickly and ends at 109 percent of the figure at time of foundation. The differences may support the idea that regions with high population density may attract another type of new firm than regions with low density do and that growth-relevant conditions differ between the regions. The differences in employment figures for Western German regions are similar to Eastern Germany in the first four

years. Contrary to the Eastern German case, cohort employment in agglomeration regions does decline in the fifth and the sixth years. In the results, all regions show a similar change in cohort employment in the sixth year: The values range between 109 and 115. The employment figures are very similar to results of Weyh (2006) in this volume.



Source: ZEW Entrepreneurship Study, authors' own computations.

Figure 5.4: Eastern German cohort-employment development according to region



Source: ZEW Entrepreneurship Study, authors' own computations

Figure 5.5: Western German cohort-employment development according to region.

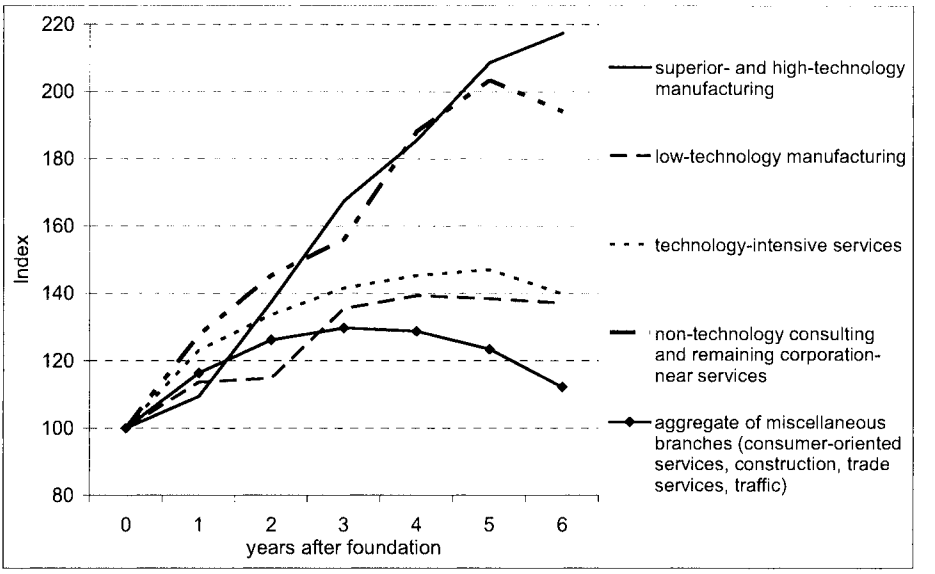
4.3 Technology and Human Capital Differentiation

Now we focus on the second main contribution of our paper: the role of new firms occupying market niches and/or entering into formative industry life-cycle stages. Firstly, we look at the cohort-employment development of different groups of firms according to their industry. Secondly, we discuss the implications regarding sharing between knowledge-intensive firms as well as of firms in high-tech and ICT-related industries in the cumulative number of employees of all newly founded firms. We are unfortunately obliged to pool the data and to depict a period of just six years. This is due to the small number of newly founded firms in our dataset attributable to the group of high-tech-oriented firms. Thus, an analysis differentiated according to year of foundation makes no sense and, consequently, we have to ignore founding information and pool the data in order to achieve a sufficient number of observations for our analysis. The loss of pooling is given by the reduction of the investigation period, which is limited by the information on employees for the youngest cohort (= cohort of new firms founded in 1993). In this case, we have information for six years.

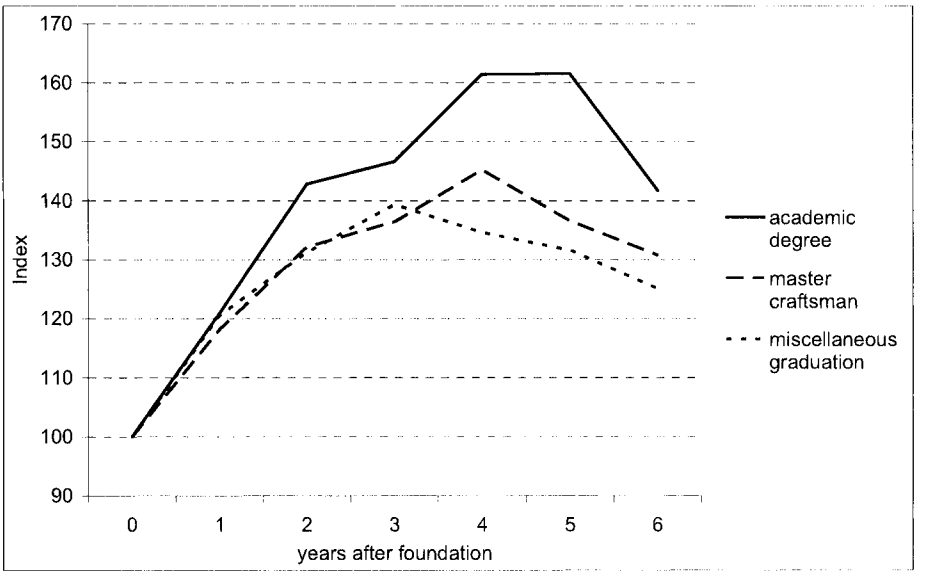
Figure 5.6 screens the cohort-employment development for five sub-groups of the private economy. It can be observed that the curve representing the cohort employment of superior-tech and high-tech firms steadily increases and reaches an index value of nearly 220 points after six years. The growth of the cohort employment of firms offering technology-intensive services or non-technical consulting services is smoother, with the curves reaching their top levels (140 and 150) in the fourth and fifth years. The cohort employment of the remaining firms in low-tech industries already reaches its top level in the third year and declines afterwards to an index level of 110 until the sixth year after foundation.

Figure 5.7 shows the cohort-employment development according to the founders' 'human capital', which is measured at the firm level by the highest academic achievement of the involved entrepreneurs. We differentiate among firms founded by academics, master craftsmen, and founders with lower qualifications. The curve representing the employment development of start-ups founded by academics outpaces the two other groups, reaching a top level of about 160 index points and falling back to 140 points in the sixth year. The end levels of each of the other two groups are about 130 points. It is amazing that the curves of these two aggregates end in close contact despite the fact that – besides the observations which were not able to be assigned – several founders lacking an apprenticeship or any other education are included in the residual group. Craft firms, however, are usually small and remain so because they are, due to regulation, confronted less with the 'pressure to grow' in order to remain in the market. It could be argued that the predominance of new 'academic' firms results from the fact that these firms operate mostly in the high-tech industries of manufacturing. However, in our sample, the smallest

share of academics founded new firms in these industries. Most academics – neglecting the aggregate of the miscellaneous industries – settled in the technology-oriented services sector. From the opposite point of view, the highest share of academic entrepreneurs can also be found in the tech services industry. The second-largest share is associated with non-technical consultants.

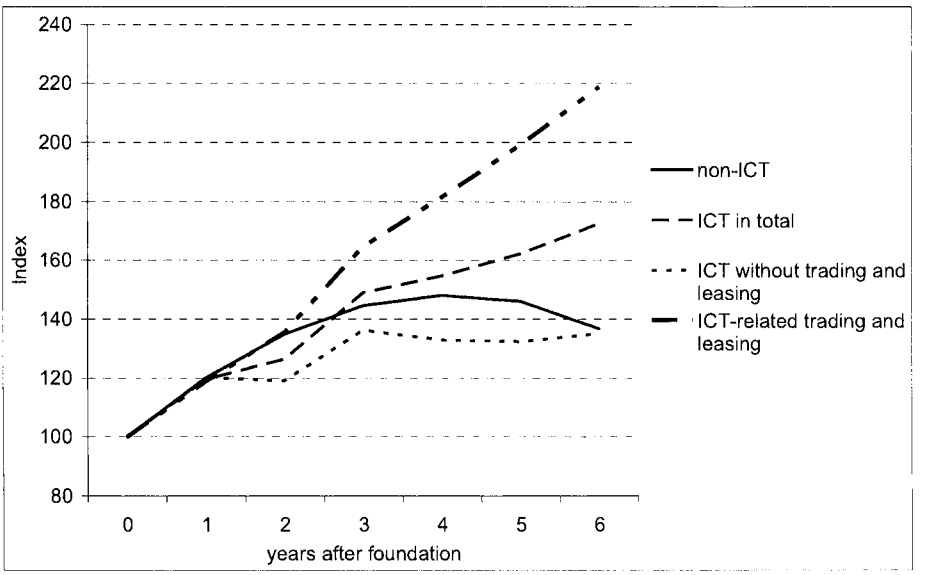


Source: ZEW Entrepreneurship Study, authors' own computations.
Figure 5.6: Industry-specific cohort-employment development



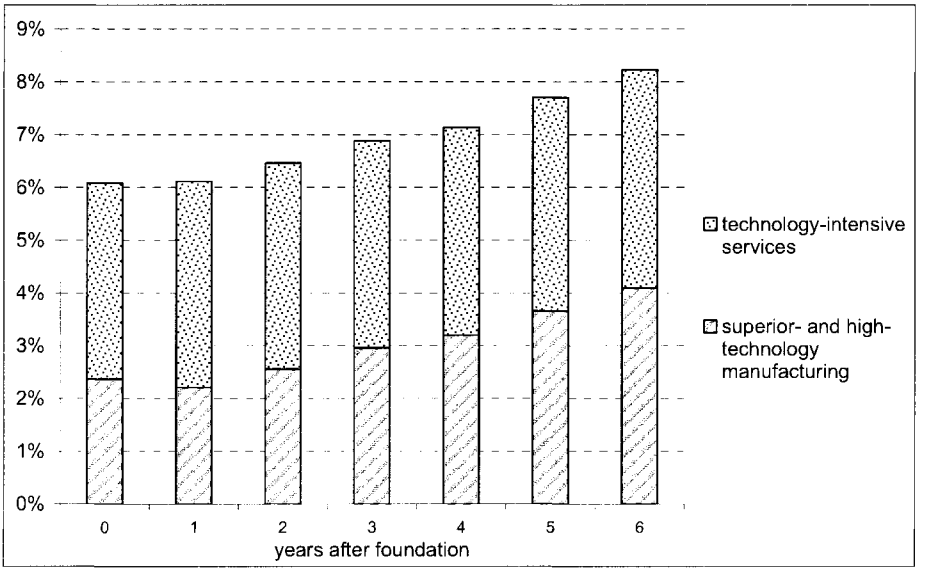
Source: ZEW Entrepreneurship Study, authors' own computations.
Figure 5.7: Cohort-employment development categorized by founders' human capital

Figure 5.8 presents the compendious employment development of new firms pertaining to the ICT sector. The analysis of the ICT sector follows the idea of separating a group of firms, which entered markets in formative stages. The four sub-groups regarded are: the ICT sector as a whole, the ICT sector without trading and leasing, ICT-related trading and leasing, and non-ICT industries. Firms with ICT-related trading and leasing activities reach an index level of about 220 at their peak and outperform the group of remaining ICT firms as well as remaining firms outside the ICT sector. It is remarkable that the cohort of software developers does not achieve a higher employment growth compared to the firms outside the ICT sector. In contrast to the results for high-tech industries, high-tech orientation does not necessarily achieve a high employment growth. In the early 1990s, computers started their diffusion into private households. Thus, the ICT-consumer market consisted mainly of retailers, which were beginning to prosper and build up employment. The boom of software developers and service suppliers started a few years later and led to flourishing founding conditions for mid-1990s ICT-cohorts.

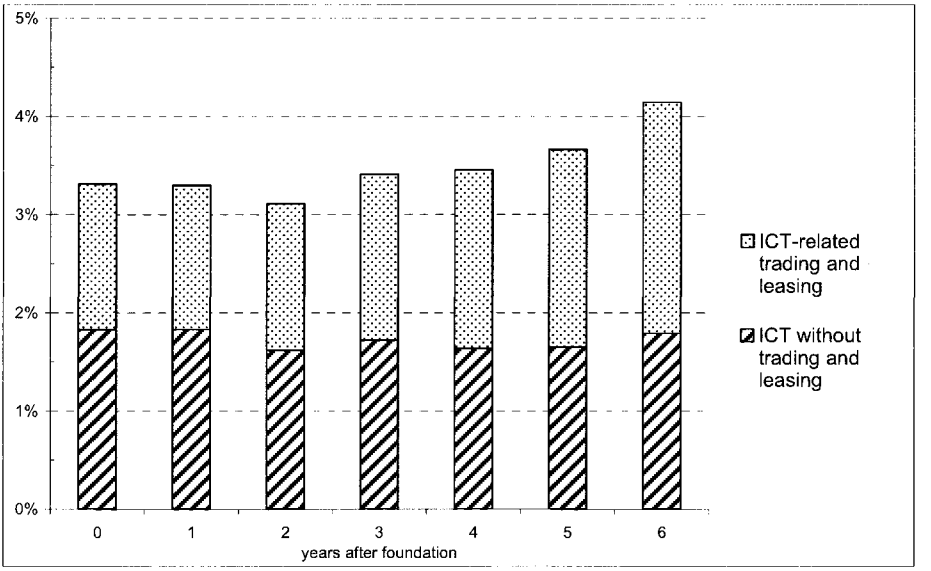


Source: ZEW Entrepreneurship Study, authors' own computations.
Figure 5.8: ICT-specific cohort-employment development

Almost all of the presented results suggest that cohorts of firms occupying market niches or entering new markets achieve higher employment growth compared to the others.



Source: ZEW Entrepreneurship Study, authors' own computations.
Figure 5.9: Job-share development of cohorts attributable to technology-intensive industries

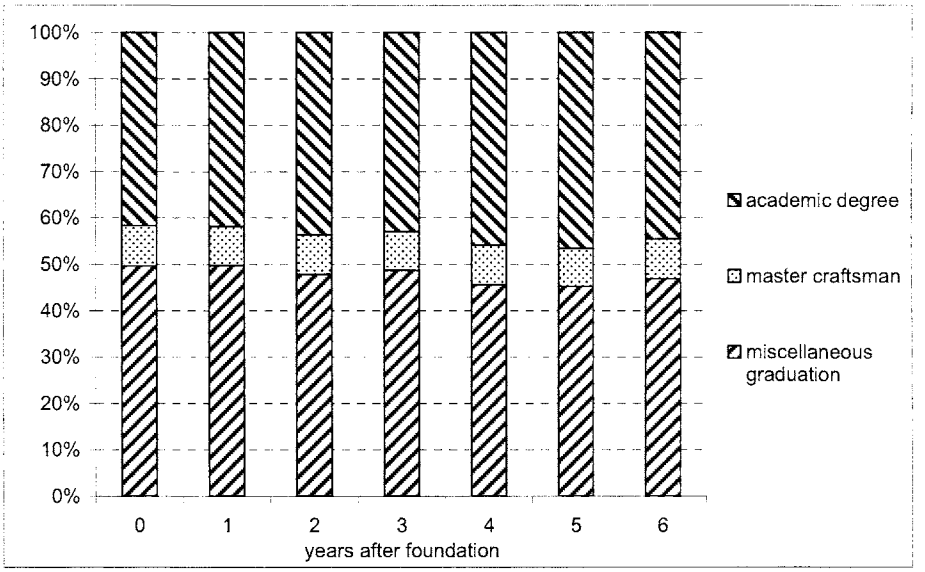


Source: ZEW Entrepreneurship Study, authors' own computations.
Figure 5.10: Cohorts' share-development in created jobs assignable to the ICT sector

One impact of the higher-than-average employment growth of new high-technology firms, knowledge-intensive firms and firms in the ICT sector is its increasing share in the overall number of jobs created by a cohort of new firms. This increase is shown by the next three figures. Six percent of the created jobs in the founding year can be attributed to firms in high-tech indus-

tries (figure 5.9). This share rises steadily to above eight percent after six years of existence. With regard to many exaggerated statements about the importance of newly founded high-technology firms for the labor market, this result falls short of expectations. The ICT sector starts as a whole with a share of just 3.2 percent. While the share of the ICT trading and leasing sector rises continuously from 1.5 to 2.4 percent, the share reflecting the second ICT group hovers around 1.7 percent, hampering the general increase (figure 5.10). Figure 5.11 screens the shares according to founders' human capital. In the founding year, 42 percent of the new jobs traceable to firms founded by academics and 8.5 percent result from foundations made by master craftsmen. In the observation period, the latter wavers around the aforementioned 8.5 percent with only moderate fluctuation. The superiority of the cohort of academic founders leads to a distinct rise in its share of jobs created to a level of 44.5 percent.

The advantage of technology-oriented and knowledge-intensive firms may be influenced by technology orientation as well as knowledge intensity. Once again, our analysis is not appropriate for deriving a causal relationship. The descriptive results tell us something about variances among different cohorts of new firms. For example, the employment figures might also result from differences in governmental support activities (see table 5.2). The table suggests remarkable differences in the share of firms funded by cheaper loans from public banks.



Source: ZEW Entrepreneurship Study, authors' own computations.

Figure 5.11: Cohorts' share-development in created jobs, categorized by founders' human capital

Table 5.2: Industry-specific supporting quotes

Industry	Support		
	Yes	No	n/a
Superior- and high-technological manufacturing	50 %	46 %	4 %
Non-technological manufacturing	41 %	56 %	3 %
Technology-intensive services	22 %	75 %	3 %
Non-technological consulting and remaining firm-related services	18 %	81 %	1 %
Miscellaneous industries (consumer-oriented services, construction, trade services, transportation)	32 %	66 %	2 %

Source: Almus et al. (2001).

5. Conclusions

The paper provides additional empirical evidence of the evolution of cohort employment of new firms and the level of their direct gross employment effect. We confirmed the inverted U-shaped curve of cohort employment at the level of firms. Newly founded Eastern German firms had a growth advantage in terms of better economic conditions – known as the 'start-up window' – inducing an advantage over their Western German counterparts. To summarize, our firm-level analysis showed similar results compared to studies based on establishment data. Our analysis provides insight at a disaggregated level of regions as well. The results for Eastern Germany suggested that agglomeration regions perform worse with respect to the evolution of cohort employment of new firms in mature stages. In contrast, differences among agglomeration regions, moderately congested regions, and rural areas are evident in the first years but declined to zero in mature stages in Western Germany.

The direct employment effect can be remarkable. Each cohort of new firms provides between 1.7 percent and 2.4 percent of all jobs in Germany at the time of foundation. The economic conditions in the early 1990s were quite extraordinary and are not representative of the present. Therefore, we expect a lower employment contribution of new firms founded at present. The employment contribution of one single cohort appears to be small; however, taking into account the high turbulence rate in the economy, numerous jobs are created and destroyed within a few years' time.

Finally, we illustrated that cohorts of firms founded in high-technology industries as well as in ICT-related trading and leasing generally perform better than other newly founded firms. This dominance was also evident in academic foundations. The employment figures implicated an increase in the share of all jobs provided by new high-tech firms in the medium-term. High-tech firms reached a share of about eight percent in the sixth year after foundation. This result emphasizes that the direct employment effects of high-tech firms are very small. Indirect employment effects may be more important due to the supply of new or better products.

References

Agarwal, R., Audretsch, D.B., 2001, Does Entry Size Matter? – The Impact of Life Cycle and Technology on Firm Survival, *Journal of Industrial Economics*, 49 (1), 21-43.

Almus, M., 2001, Das Wachstum junger Unternehmen – Eine Bestandsaufnahme nach der Wiedervereinigung, *ZEW Discussion Paper*, No. 01-40, Mannheim.

Almus, M., Engel D., Nerlinger E.A., 1999, Determinanten des Beschäftigungswachstums junger Unternehmen in den alten und neuen Bundesländern: Bestehen Unterschiede hinsichtlich der Technologieorientierung?, *Zeitschrift für Wirtschafts- und Sozialwissenschaften*, 119 (4), 561-592.

Almus M., Brüderl, J., Prantl, S., Stahl, K., Woywode M., 2001, Die ZEW-Gründerstudie - Konzeption und Erhebung. *ZEW Documentation*, No. 01-01, Mannheim.

Audretsch, D.B., Keilbach, M., 2004, Entrepreneurship Capital and Economic Performance, *Regional Studies*, 38 (8), 949-959.

Audretsch, D.B., Fritsch, M., 2003, Linking Entrepreneurship to Growth: The Case of West Germany, *Industry and Innovation*, 10 (1), 65-73.

Boeri, T., Cramer, U., 1992, Employment growth, incumbents and entrants – Evidence from Germany, *International Journal of Industrial Organization*, 10, 545-565.

Brezinski H., Fritsch M., 1995, Transformation: the shocking German way, *Moct-Most*, 5 (4), 1–25.

Bresnahan, T.F., Brynjolfsson, E., Hitt, L.M., 2002, Information technology, workplace organization and the demand for skilled labour: A Firm-level evidence. *Quarterly Journal of Economics*, 117 (1), 339-376.

Brixy U, Grotz R., 2004, Differences of the economic performance of newly founded firms in West and East Germany. In *Advances in interdisciplinary European entrepreneurship research*, M. Dowling, J. Schmude, D. zu Knyphausen-Aufsess, ed. Muenster: LIT.

Brynjolfsson, E., Hitt, L.M., 2000, Beyond Computation: Information Technology, organizational transformation and business performance, *Journal of Economic Perspectives*, 14 (4), 23-48.

Engel, D., Fier, A. 2001, "Does R&D-Infrastructure Attract High-Tech Start-Ups?" In *Knowledge, Complexity and Innovation Systems*, M.M. Fischer and J. Fröhlich, ed. Berlin, Heidelberg, New York: Springer.

Fritsch, M., 1997, New Firms and Regional Employment Change, *Small Business Economics*, 9 (5), 437-48.

Fritsch, M., 2004, Entrepreneurship, entry and performance of new business compared in two growth regimes: East and West Germany, *Journal of Evolutionary Economics*, 14, 525-542.

Fritsch, M., Weyh, A., 2004, How Large are the Direct Employment Effects of New Businesses? – An Empirical Investigation, *Freiberg Working Papers*, No. 5.

Fritsch, M., Mueller, P., 2004, The Effects of New Business Formation on Regional Development over Time, *Regional Studies*, 38 (8), 961-975.

Gehrke, B., Legler, H., Machate-Weiß, V., Schasse, U., Steincke M., Wagner, F., 1997, *Beitrag zur „Berichterstattung zur technologischen Leistungsfähigkeit"* im Auftrag des Bundesministeriums für Bildung, Wissenschaft, Forschung und Technologie, Materialband, Hannover.

Geroski, P. A., 1995, What Do We Know About Entry? *International Journal of Industrial Organization*, 13 (4), 421-40.

Geroski, P. A., Mata, J., 2002, Portugal, P., Founding Conditions and the Survival of New Firms, Working Paper, London and Lisbon.

Grupp, H., Legler H., 2000, Hochtechnologie 2000, Neudefinition der Hochtechnologie für die Berichterstattung zur technologischen Leistungsfähigkeit Deutschlands, Gutachten für das bmb+f, Karlsruhe, Hannover.

Licht, G., Steiner, V., Bertschek, I., Falk M., Fryges, H., 2002, *IKT-Fachkräftemangel und Qualifikationsbedarf*. Baden-Baden: Nomos.

OECD, 2000, Information Technology Outlook, OECD, Paris.

Porter, M., 1979, The Structure within Industries and Companies' Performance. *Review of Economics and Statistics,* 61 (2), 214-27.

Winter, S., 1984, Schumpeterian Competition in Alternative Technological Regimes. *Journal of Economic Behavior and Organization,* 5 (3-4), 287-320.

Weyh, A., 2006, What Characterizes the Success of Start-Up-Cohorts?, in this volume.

6 HOW FAST DO NEWLY FOUNDED FIRMS MATURE?

Empirical Analyses on Job Quality in Start-Ups*

Udo Brixy, Susanne Kohaut and Claus Schnabel

1. Introduction

Economic policy in Germany strongly stimulates the founding of new firms, not least because politicians hope that new firms may create the additional employment that is so desperately needed in Germany. In order to find out whether this is really the case and how successful new firms are, a growing empirical literature has studied the performance of new firms at various levels of aggregation. At the micro level, i.e. using data of individual firms or establishments, quite a few studies have been published in the last decade that analyze the success of newly founded firms over the years in terms of survival rates, employment growth, and other indicators of firm performance (see, e.g., Wagner, 1994; Brüderl et al., 1996; Brixy and Kohaut, 1999; Almus, 2002). From a macro perspective, using the concepts of job creation, job destruction and job turnover, a number of studies have tried to identify the extent to which new firms contribute to aggregate employment growth (see, e.g., Boeri and Cramer, 1991; Bellmann et al., 1996; Gerlach and Wagner, 1997; Turk 2002; Brixy and Grotz, 2004).[1]

Most of this research has concentrated on the number of new jobs created, although the persistence of these jobs has also been taken in consideration. This reflects the insight that not only the *quantity* but also the *quality* of (new) jobs is important. The quality of employment has also been stressed recently by the European Commission (2001: ch. 4) and is part of its employment strategy. While it may be difficult to define and measure the characteristics

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1 International studies at the micro level include Dunne et al. (1989) for the US and Storey (1994) for the UK; macro analyses are provided, inter alia, by Davis et al. (1996) for the US and Barnes and Haskel (2002) for the UK.

which best reflect job quality, wages and working conditions as well as labor fluctuation in the plant are surely among potential indicators. Whether these indicators differ between newly founded and incumbent firms has received surprisingly little attention in empirical research so far. It would also be interesting to know whether such differences – if they exist – vanish over time once the new business matures and how fast such a convergence takes place. In other words, we do not know how long it takes until a new firm becomes an incumbent firm.

This paper seeks to overcome this research deficit by analyzing differences in wages, bargaining coverage and labor fluctuation between newly founded and other firms in Germany in the period from 1997 to 2001. It makes use of a representative sample of establishments that were founded in 1995/96 and that form part of a large-scale set of establishment data in Germany. This unique data set is described in section 2. Section 3 analyzes the determinants of labor fluctuation and traces the observed differences in labor turnover of the cohort of newly founded establishments over time. In a similar way, the wage differential of newly founded establishments is investigated in Section 4, and their bargaining coverage is compared to that of other plants. Section 5 provides some concluding remarks and suggestions for future research.

2. The Data

The data used in this study is derived from two sources that are closely interrelated and together form an employer-employee data set. The employee side of the data set is the "German Employment Statistics", which is sometimes also called the "German Social Insurance Statistics" (see Fritsch and Brixy 2004 for details). It requires all public and private employers to report certain information about every employee who is subject to obligatory social insurance, i.e. health and unemployment insurance along with pension funds. Misreporting is legally sanctioned. The information collected is transformed into an establishment file that provides longitudinal information about the establishments and their employees and which is called "IAB Establishment Register".[2] A great advantage of this database is that it covers all establishments that employ at least one employee who is liable to social insurance. The attributes of each firm covered in this database are the number of employees, their sex, age, and qualification (four levels) as well as the wages and salaries paid and the exact duration of the engagement in days. Although these data refer to individuals, only aggregate data at the establishment level were available to us.

The employer side of our data set is given by the "IAB Establishment Panel", a random sample of establishments from the comprehensive IAB Es-

2 IAB is an acronym for "Institut für Arbeitsmarkt- und Berufsforschung", which is the research institute of the German Federal Employment Agency.

tablishment Register drawn according to the principle of optimal stratification. The stratification cells are defined by ten classes for the size of the establishment and by 16 economic sectors. This selection process means that the selection probability of an establishment increases with its size. Every year since 1993 the IAB Establishment Panel has surveyed the same establishments from all branches and different size categories in western Germany (and since 1996 in eastern Germany). In order to correct for panel mortality, exits and newly founded establishments, the panel is augmented regularly. The questionnaire covers a wide variety of questions which can be used for our analysis, such as information on the legal form, the profit situation and the location of the establishment, the state of production technology and on bargaining coverage. Data are collected in personal interviews with the owners or senior managers of the establishments by professional interviewers.[3]

In 1997, a representative sample of establishments that reported under a new firm-identification-number in the employment statistics was drawn and integrated into the IAB Establishment Panel. From this sample, 826 newly founded establishments can be used in our analysis, 368 of which can be traced every year until 2001 (although not all of these establishments provide information on all variables in every year). Each of these newly founded establishments hired its first employee between July 1, 1995 and June 30, 1996. Our sample was restricted to establishments that had less than 200 employees in 1997[4] and that were in private ownership of one or more founders but were not owned by other firms, so there are no derivative foundations. The development of these newly founded establishments is contrasted with 4,525 incumbent establishments from the private sector that had already existed in 1996 and had employed at least one and less than 200 employees in 1997. Of these establishments, 3,083 could be traced in every year until 2001, the last year in which information from both the employees' and the employers' side is available.

In our empirical analysis we predominantly make use of the data from the IAB Establishment Panel. In addition, exact data on the composition of the workforce, the number of employees, labor fluctuation, and the amount of wages and salaries paid in the establishment are supplied from the quasi-official German Employment Statistics via the IAB Establishment Register. The data are linked through a plant identifier that is available in both data sets.

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3 Details regarding the IAB Establishment Panel (including information on the questionnaires and how to access the data) are given in Kölling (2000).

4 We do not use the full sample because we want to compare groups of plants that are roughly similar with respect to establishment size. While in the unrestricted sample there would be many incumbent firms with more than 200 employees, there is only one newly founded establishment that is larger, and this seems to be an outlier; on average the start-ups had five employees.

Table 6.1: Newly founded and incumbent establishments in Germany 1997 (sample restricted to establishments with less than 200 employees)

	Western Germany			Eastern Germany		
Establishment characteristics	Newly founded	Incumbent	Difference (t-test)	Newly founded	Incumbent	Difference (t-test)
Establishment size (no. of employees)	2.4	8.3	-5.9** (-278.1)	4.2	9.6	-5.3** (-73.5)
Female employees (%)	40.5	47.0	-6.5** (-40.3)	47.8	48.2	-0.4 (-1.6)
Part-time employees (%)	17.5	15.5	2.0** (15.4)	9.4	9.4	-0.0 (-0.1)
Fixed-term employees (%)	1.4	1.6	-0.2** (-8.2)	2.1	1.9	0.2** (3.3)
High-skilled employees (%)	7.3	2.1	5.2** (58.8)	5.0	5.5	-0.4** (-4.3)
Low-skilled employees (%)	25.9	24.9	1.0** (6.7)	21.9	16.3	5.7** (27.4)
Export share (%, in 1996)	3.3	2.5	0.9** (15.9)	1.2	0.8	0.4** (8.8)
State-of-the-art production technology (%)	67.0	65.0	2.1** (12.4)	70.0	66.0	3.9** (15.6)
Labor turnover rate	0.7	0.5	0.2** (70.0)	0.7	0.4	0.3** (61.6)
Hiring rate	0.6	0.4	0.2** (57.6)	0.6	0.3	0.3** (63.0)
Departure rate	0.8	0.5	0.2** (63.5)	0.8	0.5	0.4** (47.6)
Covered by a collective agreement (%)	39.0	59.0	-20.0** (-116.3)	31.0	41.0	-10.0** (-40.5)
Daily wage (€)	58.4	60.1	-1.7** (-15.9)	42.8	47.1	-4.3** (-50.2)

Note: Weighted data based on information about 255 new and 2153 incumbent establishments in western Germany and 571 new and 2372 incumbent establishments in eastern Germany; two-sample t-test with unequal variances; ** denotes statistical significance at the 0.01 level.

Source: IAB Establishment Panel, German Employment Statistics.

Some descriptive evidence based on weighted data from our representative set of data is presented in table 6.1. Since labor markets and economic conditions still differ considerably between western and eastern Germany, we provide disaggregated information for both regions. The comparison of newly founded and incumbent establishments shows that there were substantial (and statistically significant) differences between both groups in 1997. On average, newly founded establishments were much smaller and had a slightly higher export share than incumbents. More of them said that their production technology was state of the art, but their share of low-skilled employees was also higher than in incumbent establishments. Concerning our indicators of job

quality, new establishments were characterized by a higher labor fluctuation (measured by the labor turnover rate, the hiring rate and the departure rate explained below), by a lower bargaining coverage and by lower wages than incumbents. It will be interesting to see whether these differences still show up in multivariate analyses.

3. Labor Fluctuation

Since newly founded firms, by definition, have no current employees and cannot fill vacancies through vocational training or promotion in internal labor markets, they need to attract employees from the external labor market. Potential employees will compare the quality of the job offered with the quality of their current job or with what they are offered by other firms. When assessing quality, employees can be expected to not only look at compensation and working conditions but also at the (expected) employment stability and the labor fluctuation rates in new firms.

It is well known that new firms are more likely to fail than incumbent ones what has been termed "the liability of newness" by Stinchcombe (1965). The risk of failure tends to increase within the first year(s) and to decrease non-monotonically afterwards.[5] Interestingly, at the aggregate level employment is usually rather stable in the sense that the number of employees working in a cohort of firms tends to stabilize over time at a level roughly comparable to the size in the year of entry since the "decline of employment in a cohort due to exiting firms ... is more or less compensated by the growth of survivors of the same cohort." (Wagner, 1994, 144).[6] This observation makes clear that there is a lot of heterogeneity behind the aggregate stability: While the majority of new firms do not change employment size in their first years, some shrink, others dissolve, and a few show a rapid expansion and account for the lion's share of employment growth and of total employment after ten years (see Brüderl et al., 1996; Almus, 2002; Fritsch and Weyh, 2004).

These insights are interesting, but they do not fully reflect the labor fluctuation at the plant level and an individual employee's chance of employment stability. For reasons of data availability, most studies are only able to investigate *net* employment flows, that is whether the total number of employees in a plant has changed between two points in time. It could well be, however,

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5 Depending on the data sets and the periods of observation used, German studies differ at the exact shape and length of this process; see, e.g., Brüderl et al. (1996, 94ff.), Gerlach and Wagner (1997), Turk (2002) and Fritsch and Weyh (2004).

6 While this is a stylised fact for western Germany (see also Boeri and Cramer, 1991; Brixy and Grotz, 2004), in eastern Germany for a short period after unification an exceptionally positive "start-up window" for new firms seemed to exist which resulted in substantial employment gains of several cohorts (see Brixy and Kohaut, 1999).

that several hires and departures have taken place in this period whereas the total level of employment has remained the same. Since our linked employer-employee data set contains information on the beginning and the end of each employment relationship, we are able to analyze *gross* employment flows and labor fluctuation in each plant. To the best of our knowledge, no empirical studies exist that have explicitly addressed these issues with German or international data on newly founded firms.

For various reasons we would expect newly founded firms to record a higher labor fluctuation than similar incumbent firms. Since the likelihood of termination of an employment contract (by either party) declines with tenure (Franz, 2003, 197), incumbent firms with a certain history of job matches tend to have higher employment stability than newly founded firms hiring their first employees. These new firms will have to go through the usual matching process characterized by trial and error when attempting to hire suitable employees. In addition, new firms face the problem that due to their higher risk of failure (and their lower wages analyzed below) they may not be able to poach employees from other firms but may have to rely more on attracting workers who are currently unemployed. If unemployed people are less able (or willing) to fulfil the requirements of the job, there is a higher risk of layoffs or quits in new firms (followed by a new process of hiring). Since newly founded firms also tend to face higher uncertainty and fluctuation in demand for their products or services while at the same time having less financial resources to hoard labor in weaker periods, they may have to adjust employment more often than incumbent firms.[7] Over time, these differences should become smaller and even vanish once the critical initial period of new employment relationships is over and the economic situation of the new firms stabilizes.

To analyze these issues, an appropriate dependent variable and a well-known indicator of labor fluctuation is the labor turnover rate, which is defined as the ratio of the sum of hires and departures in a plant over its average employment level in a given year. Of course, hires and departures may also be analyzed separately, relative to average employment levels.[8] This means that we can make use of three dependent variables that reflect various aspects of labor fluctuation, with the labor turnover rate being the most encompassing

7 The higher chance of failure of newly founded firms could also imply higher departures if firms or employees react accordingly when they see the shadow of death sneaking around the corner in the months or years before the exit. There is, however, conflicting empirical evidence as to whether this is the case in Germany; see Wagner (1999) and Almus (2002).

8 More precisely, following standard practice and in order to achieve some consistency with the rates of hires / employment and of departures / employment, the labor turnover rate was calculated as 0.5 (hires + departures) / employment (see Franz, 2003, 194). We dropped a few establishments with labor turnover rates of 3 and above since these may reflect some errors in the data base (the mean of this rate is about 0.4 in our sample). Note that departures are a composite measure that includes dismissals, quits, and retirement, *inter alia*.

one. We estimate OLS regressions for the period from 1997 to 2001, making use of stacked cross section models for each year as well as pooling the data, and we provide disaggregated estimates for the different labor markets of western and eastern Germany.

The main interest of our analysis is the labor fluctuation in newly founded establishments, which are represented by a dummy variable indicating whether an establishment hired its first employee between July 1, 1995, and June 30, 1996. The other independent variables used are standard in labor turnover regressions of this sort.[9] They include establishment size because for purely mechanical reasons the labor turnover rate is usually higher in small establishments where the entry or exit of one single employee has a higher percentage effect. In order to take account of potential non-linearities in this relationship, we also include the square of establishment size. Potential spill-over effects in personnel policies from the mother firm are accounted for by a dummy variable indicating whether the establishment is a branch plant or subsidiary. We control for the structure of the workforce using the employment shares of female, part-time, and low/high-skilled employees and we take into account that establishments with a high proportion of fixed-term employees should have a higher labor turnover. Since collective bargaining agreements are often said to inhibit labor force adjustments we include dummy variables on the existence of sectoral or firm-level collective agreements. Employees can be expected not to leave establishments that pay well and are in good economic shape. Therefore the average level of wages in the establishment, a dummy variable reflecting its subjective assessment of the ("very good or good") profit situation and a dummy variable for its state of production technology are included in the analysis. The situation on the regional labor market is reflected by the regional rate of unemployment; however, since high unemployment might be associated with less quits and hires but more layoffs, its total effect on labor turnover is open.[10] As further controls we also include ten industry dummies and three dummies for the degree of urbanization at the location of the establishment (highly agglomerated, densely populated or rural regions).

9 See, for instance, Addison et al. (2001). Note that although we have a relatively rich data set, selection of control variables was limited by the fact that information on some potential explanatory variables was either never asked (this is the case for the capital stock and for fringe benefits) or was not available in all years of our observation period (e.g. existence of a works council and profit sharing).

10 In the estimations with Stata/SE 8.2, we made use of the *cluster* option to take into account that the unemployment data at district level are at a different level of aggregation than the establishment data and that the unobserved influences on the dependent variables may be not independent in establishments from the same district.

Table 6.2: Determinants of labor turnover and wages in Germany, 1997-2001 (OLS estimations; pooled data; establishments < 200 employees)

Dependent variables	Labor turnover rate		ln wage	
Explanatory variables	Western Germany	Eastern Germany	Western Germany	Eastern Germany
Constant	1.0356**	1.2700**	4.1973**	3.9990**
	(8.44)	(13.24)	(123.97)	(89.30)
Newly founded establishment	0.0979**	0.1468**	-0.0901**	-0.0570**
(dummy: 1 = yes)	(2.85)	(8.87)	(-2.91)	(-3.87)
Establishment size	-0.0008**	-0.0010**	0.0016**	0.0006**
(number of employees)	(-5.17)	(-5.60)	(10.91)	(4.53)
Establishment size squared	4.42e-07**	6.26e-07**	-7.30e-07**	-2.23e-07*
	(3.92)	(4.98)	(-6.14)	(-2.53)
Branch plant/subsidiary	0.0442**	0.0265	0.0521**	0.0954**
(dummy: 1 = yes)	(2.68)	(1.75)	(3.45)	(5.59)
Female employees	-0.0017**	-0.0020**	-0.0028**	-0.0037**
(percentage)	(-5.56)	(-7.75)	(-12.31)	(-8.28)
Part-time employees	0.0006	0.0007*	0.0019**	0.0037**
(percentage)	(1.50)	(2.00)	(4.38)	(8.28)
Fixed-term employees	0.0108**	0.0065**	0.0003	-0.0004
(percentage)	(7.38)	(10.90)	(0.57)	(-1.47)
High-skilled employees	0.0002	0.0001	0.0062**	0.0059**
(percentage)	(0.32)	(0.23)	(11.82)	(17.22)
Low-skilled employees	0.0017**	0.0009**	-0.0019**	0.00004
(percentage)	(5.39)	(4.09)	(-7.38)	(0.27)
Covered by sectoral collective	-0.0228	-0.0331**	0.0619**	0.0921**
agreement (dummy: 1 = yes)	(-1.71)	(-2.80)	(4.33)	(9.52)
Covered by firm-level collective	-0.1545**	-0.0100	0.0478**	0.0484**
agreement (dummy: 1 = yes)	(-5.90)	(-0.71)	(2.83)	(4.78)
Wage level	---	-0.1988**	---	---
(ln daily wage per employee, in €)		(-8.43)		
Firm receives wage subsidies	-0.0119	---	-0.0114	-0.0534**
(dummy: 1 = yes)	(-1.02)		(-1.02)	(-6.89)
Profit situation		-0.0350**	0.0395**	0.0558**
(dummy: 1 = very good/good)		(-3.56)	(3.73)	(7.33)
Export share	---	---	0.0021**	0.0009*
(percentage)			(6.84)	(2.19)
Production technology	-0.0232	-0.0592**	0.0577**	0.0420**
(dummy: 1 = state of the art)	(-1.86)	(-3.95)	(5.90)	(5.42)
Legal form of the firm	---	---	-0.1750**	-0.1668**
(dummy: 1 = family-owned firm)			(-11.86)	(-16.32)
Regional unemployment rate	0.0001	-0.0005	-0.0007	-0.0051*
(at district level, in percent)	(0.06)	(-0.23)	(-0.36)	(-2.41)
Year dummies	yes*	yes	yes**	yes**
Industry dummies	yes**	yes**	yes**	yes**
Urbanization dummies	yes**	yes	yes**	yes**
N	7389	9436	7037	9203
R^2	0.1413	0.1380	0.4606	0.4819

Note: Heteroscedastic-consistent t-values in parentheses; **/* denote statistical significance at the 0.01 and 0.05 levels, respectively; see text for exact definitions of dependent variables.

Source: IAB Establishment Panel, German Employment Statistics.

The results of the pooled estimations of the labor turnover rate for the period 1997 to 2001 (which also include dummies for each year) are presented in columns 2 and 3 of table 6.2. It can be seen that most of the coefficients estimated are of the expected sign, but not all of them are statistically significant at conventional levels, and the overall explanatory power of the regressions is modest. While the impact of control variables does not need to be discussed in detail, it is important to note that newly founded establishments have higher labor turnover rates than incumbent ones. This difference shows up in western as in eastern Germany and is statistically significant at the 1 percent level, thus confirming our theoretical hypothesis above.

The estimated coefficients of the dummy variables for newly founded establishments can be interpreted as follows: The average labor turnover rate in our sample is 0.39 in western and 0.42 in eastern Germany, which means that labor fluctuations (i.e. hires and departures) amount to 39 and 42 percent of the average stock of employment, respectively. In newly founded establishments, this rate is 9.8 percentage points higher in western Germany and even 14.7 percentage points higher in eastern Germany. In other words, over the first five years labor turnover rates in newly founded establishments are one quarter to one-third higher than in incumbent establishments.

Table 6.3: Labor fluctuation in newly founded establishments over time (coefficients of OLS estimations similar to table 6.2, columns 2 and 3)

Indicator, region	1997	1998	1999	2000	2001
Labor turnover rate					
Western Germany	0.1583**	0.1341**	0.0123	0.0432	0.0232
	(3.26)	(2.64)	(0.23)	(0.68)	(0.32)
	[N=2042]	[N=1686]	[N=1376]	[N=1058]	[N=901]
Eastern Germany	0.1725**	0.1749**	0.1339**	0.0566	0.0699
	(6.93)	(5.93)	(4.33)	(1.41)	(1.43)
	[N=2621]	[N=2134]	[N=1776]	[N=1354]	[N=1189]
Hiring rate					
Western Germany	0.1659**	0.1675**	0.0304	0.0357	0.1010
	(3.22)	(2.99)	(0.57)	(0.55)	(1.17)
Eastern Germany	0.1766**	0.1763**	0.1274**	0.0801	0.0613
	(5.19)	(6.37)	(3.32)	(1.82)	(1.08)
Departure rate					
Western Germany	0.1507*	0.1008	-0.0058	0.0507	-0.0546
	(2.33)	(1.48)	(-0.09)	(0.64)	(-0.81)
Eastern Germany	0.1685**	0.1736**	0.1405**	0.0330	0.0786
	(4.97)	(3.74)	(3.47)	(0.53)	(1.21)

Note: Heteroscedastic-consistent t-values in parentheses; **/* denote statistical significance at the 0.01 and 0.05 levels, respectively; see text for exact definitions of dependent variables.

Source: IAB Establishment Panel, German Employment Statistics.

In addition to the average effects over the whole period shown in table 6.2, table 6.3 presents the results of cross section estimations for each single year. The models estimated are almost identical to those shown in table 6.2, the only differences being that the year dummies are not included, of course, and that for all years except 1999 (where information is lacking) a dummy variable on the existence of overtime work is included. In order to economize on space, table 6.3 just presents the estimated coefficients of the dummy variable for newly founded establishments (full results are available from the authors on request). It can be seen that the labor turnover rate in newly founded establishments is higher than in incumbent establishments only for a relatively short period of time and that start-ups assimilate fast: After three years in western Germany and four years in eastern Germany, the difference in labor turnover rates between both types of plants is not statistically significant any more.[11]

Table 6.3 also provides estimates of hires and departures that largely mirror the labor turnover results. As expected, hiring in newly founded establishments is stronger than in similar incumbent establishments, but only in the first two to three years. The same is true for departures: Already in the second year in western Germany and in the fourth year in eastern Germany, jobs in newly founded establishments seem to be as stable as those in incumbent establishments. These results probably reflect an initial period of new employment relationships, uncertainty and likely failure of newly founded firms that is characterized by difficult matching processes and a higher frequency of labor adjustment in both directions. They show that, concerning labor fluctuation, it takes a new plant only a few years to become an incumbent plant.

4. Bargaining Coverage and Wage Setting

In Germany, wages and working conditions are predominantly determined by collective bargaining between trade unions and employers associations or single employers at sectoral or firm level, respectively. Since the powerful German trade unions have been able to push through wages that are relatively generous in international comparison and since negotiated working conditions (such as working hours, annual leave or fringe benefits) are usually much better than stipulated by law, establishments and employees covered by collective bargaining can be assumed to have high-quality jobs. Bargaining coverage may thus be interpreted as a crude catch-all indicator of job quality.

11 Since these results might be affected by the failure (or non-reporting) of newly founded and other establishments in the panel, we tested this by including a dummy variable for establishments which survived until 2001 and an interaction term of surviving and newly founded establishments in the regressions on which the upper part of table 6.3 is based. While labor turnover was found to be significantly lower in surviving establishments, among newly founded establishments we did not find an (additional) systematic difference between survivors and non-survivors, and the difference in labor turnover rates between new and incumbent establishments still vanishes in the third year in western Germany and in the fourth year in eastern Germany.

Although less than 50 percent of establishments in western Germany and just about 25 percent of establishments in eastern Germany are covered by collective agreements, these agreements determine wages and working conditions of about 70 percent of employees in western and 45 percent of employees in eastern Germany: In addition, several firms that are not officially bound by collective agreements use them as a point of reference in setting wages and working conditions (see Kohaut and Schnabel, 2003).

Making use of representative data from the IAB Establishment panel and concentrating on our restricted sample of establishments with less than 200 employees, table 6.4 compares the bargaining coverage of newly founded establishments with that of incumbent establishments in several size intervals. It can be seen that in 1997 only 39 percent of newly founded establishments in western Germany were covered by a collective agreement, whereas among incumbents the bargaining coverage rate was 59 percent. This overall difference of 20 percentage points is statistically significant, and similar differences show up in each size interval. In eastern Germany, where the bargaining coverage is generally lower, newly founded establishments are also significantly less likely to be covered by a collective agreement than incumbent ones.

Table 6.4: Bargaining coverage of establishments (share of establishments covered by a collective agreement, in percent)

Western Germany	1997		1999		2001	
Establishment size interval (employees)	Newly founded	Incumbent	Newly founded	Incumbent	Newly founded	Incumbent
1 to 4	37	46	34	31	40	40
5 to 9	39	64	47	50	60	58
10 to 19	54	70	27	57	42	51
20 to 199	---	76	---	73	---	67
Average	39	59	38	46	46	51
Eastern Germany	1997		1999		2001	
Establishment size interval (employees)	Newly founded	Incumbent	Newly founded	Incumbent	Newly founded	Incumbent
1 to 4	27	32	13	18	25	21
5 to 9	39	41	28	27	21	29
10 to 19	34	50	32	45	18	38
20 to 199	62	66	52	53	38	53
Average	31	41	19	30	24	30

Note: weighted data (cross-section weights); --- indicates that data may not be published due to an insufficient number of observations

Source: IAB Establishment Panel.

Over time, there is a certain convergence between both types of plants, which is partly due to the falling coverage rates of incumbents reflecting the

gradual erosion of the German system of industry-wide wage bargaining. Even in 2001, however, the bargaining coverage rate of newly founded establishments was significantly lower than that of incumbents in western and eastern Germany. This result is consistent with econometric evidence from Kohaut and Schnabel (2003) showing that young establishments (i.e. those founded in the last five years) are less likely to be bound by collective agreements.

While coverage by a collective agreement does give a good general impression on the quality of wages and working conditions in a plant, a more precise indicator is the level of wages. Newly founded firms are usually equated with small firms, and we know that these tend to pay lower wages, *ceteris paribus* (standard references include Brown et al., 1990 and Oi and Idson, 1999; for Germany, see Schmidt, 1995 and Wagner, 1997). It is an open question, however, whether newly founded firms pay higher or lower wages than incumbent firms of the same size.[12]

There are several reasons why wages in newly founded firms may differ from those in incumbent firms (for more general discussions see Brown and Medoff, 2003 and Brixy et al., 2004). On the one hand, newly founded firms may have to pay higher wages than incumbent ones in order to attract employees from the external labor market. If potential employees take into consideration that newly founded firms are much more likely to expire than older ones and have a higher labor turnover, they can be expected to demand higher wages than those that they receive from their current employers (or are offered by other firms) in the sense of a wage differential compensating for the increased risk of a job loss. Wage demands will also be higher if potential employees recognize that newly founded firms offer fewer fringe benefits (such as pension plans) than long-established firms. With a falling risk of failure (and an increase in fringe benefits) over time, the size of this compensating wage differential can be expected to fall.

On the other hand, wages in newly founded firms may be lower than those in incumbent firms because of their lower ability to pay. In the start-up phase of a business it is essential for survival to keep labor costs as low as possible, and any claim of inability to pay higher wages is much more credible (and more likely to be accepted by the employees) when made by a newly founded firm than by a long-surviving firm. Furthermore, newly founded firms do not have to pay the wage premiums for tenure and firm-specific knowledge which

12 There is an emerging literature that tries to find out whether the age of a firm has an influence on the wages paid to its employees and that provides some information on the wage differential of young firms (see, e.g., Audretsch et al., 2001 for the Netherlands, Brown and Medoff, 2003 for the US and Kölling et al., 2002 for Germany). However, these studies do not pay special attention to newly founded firms and do not follow an age cohort of firms over time.

employees in incumbent firms command.[13] Over time, this negative wage differential should become smaller since a firm's ability to pay can be expected to rise and since its employees acquire tenure and valuable firm-specific human capital.

These contrasting theoretical hypotheses suggest that an empirical investigation may be worthwhile. As in the analyses of labor fluctuation we estimate OLS regressions for the period from 1997 to 2001, making use of stacked cross section models for each year as well as pooling the data. The dependent variable is the log of daily wages per (full-time equivalent) employee at the establishment level. It is calculated by dividing the annual sum of all wages and salaries in an establishment by the sum of (calendar) days worked by all employees in this establishment. Since the number of days with part-time work is divided by 0.5, we in fact calculate a sort of "full-time equivalents" of employment. Because of part-time work and fluctuations in employment, our denominator is more precise than just using the number of employees at some point in time. The data stem from the "German Employment Statistics" and include all wages and salaries paid to each employee during a job up to the contribution assessment ceiling of the social security system. Since higher earnings are censored at this ceiling, wages in firms of high-income sectors are underreported. Although there is a certain downward bias in our wage variable, this should not systematically and seriously affect our results on the wage differential.[14]

Again our main explanatory variable of interest is the dummy variable indicating whether an establishment hired its first employee between July 1, 1995, and June 30, 1996. The control variables are quite similar to those in the labor turnover regressions above. They include the number of employees in the establishment and its square (which are expected to exhibit the well-known positive but decreasing establishment size effect on wages) as well as

13 In this case, the new firm may not be able to poach employees from other firms but may rely more on attracting workers who are currently unemployed, who are out of the labor force or who search for their first job. Non-monetary incentives that help newly founded firms to hire employees in spite of lower wages may also exist. These include enthusiasm for the business idea and the attractiveness of a situation with flat hierarchies where structures can still be formed. Some employees could also speculate that they are first in line and therefore in a good position for a career within the firm. Others may prefer to stay in the region where they finished their education and/or where they are well integrated in networks of friends and family. For a detailed analysis of incentives and incentive schemes in new firms, see Bau (2003).

14 This contribution assessment ceiling is relatively high, amounting to 148 € in western and 124 € in eastern Germany per calendar-day in 2001. As the wage variable used is calculated at the establishment level, whereas the contribution assessment ceiling refers to the individual level, there is no clear-cut truncation point which could be taken into account by choosing appropriate estimation methods (such as Tobit or truncated regression). At the other end of the spectrum, there was a small number of wages reported that were obviously too low and that probably reflected errors in the data base. We therefore omitted all incomes that were lower than twice the wages paid for so-called "mini jobs" (for which only flat-rate taxes are paid). This lower threshold was 21.18 € per day in 2001 in both parts of Germany.

a dummy variable indicating whether the establishment is a branch plant or subsidiary (thus probably paying higher wages than similar independent firms). The structure of the workforce is represented by the employment shares of female and low-skilled employees (both of which are expected to receive lower wages), of high-skilled employees (with higher wages), and of fixed-term and part-time employees. Although there is no such thing as a unionized establishment in Germany, it is necessary to control for the existence of sectoral or firm-level collective bargaining agreements, both of which are expected to raise wages. The establishment's ability to pay is expressed by a dummy variable reflecting its profit situation. We also take into account the state of production technology in the establishment, which should be positively correlated with wages, as well as the regional unemployment rate, which can be expected to reduce wages. Additional explanatory variables are the export share of an establishment, which should be associated with rising wages, the existence of wage subsidies and the legal form of the firm, although we have no clear-cut priors on the likely influence of the latter variables on the wages paid. We also include ten industry dummies and three dummies for the degree of urbanization at the location of the establishment. Since wages in western Germany are still substantially higher than in eastern Germany and since both labor markets still differ considerably, we again provide disaggregated estimates for both regions.

The results of the pooled estimations for the period from 1997 to 2001 (which also include dummies for each year) are presented in table 6.2. For western and eastern Germany alike, the goodness of fit of the regressions is relatively high, and almost all coefficients estimated are significant and of the expected sign. The principal result is, of course, the negative effect of the newly founded establishment dummy on log wages. Over the entire period, wages paid in newly founded establishments in western Germany were 8.6 percent lower than in other establishments, whereas in eastern Germany this average wage differential was just 5.5 percent.[15] This difference probably reflects the fact that wages in eastern Germany are about 20 percent lower, *ceteris paribus*, and that new establishments thus may have less scope for paying even lower wages there.

In addition to the average effects over the whole period shown in table 6.2, table 6.5 presents the results of cross section estimations for each single year. The models estimated are almost identical to those shown in table 6.2,[16] and by and large they are equally well determined. In order to economize on space, table 6.5 just presents the estimated coefficients of the dummy variable for newly founded establishments (full results are available from the authors on request). It can be seen that the point estimates of the wage differential

15 The percentage wage effect is calculated from the estimated coefficient β as $(e^{\beta}-1)\cdot 100$.

16 As before, the only differences are that the year dummies are not included, of course, and that for all years except 1999 (where information is lacking) a dummy variable on the existence of overtime work is included which always proves to be significant.

tend to fall and lose significance over time: While in 1997 wages were 9.4 percent lower in newly founded western German establishments than in other plants, *ceteris paribus*, in 2001 the point estimate of the wage differential between these two groups of plants was just 4.4 percent. In eastern Germany, the wage differential fell from 5.7 percent in 1997 to 3.8 percent in 2001.[17] Moreover, the wage differential between newly founded and incumbent establishments becomes statistically insignificant after four years in western Germany, whereas in eastern Germany this process takes five years.

Table 6.5: Wage differentials of newly founded establishments over time (coefficients of OLS estimations similar to table 6.2, columns 4 and 5)

	1997	1998	1999	2000	2001
Western Germany	-0.0988**	-0.0891**	-0.0864*	-0.0576	-0.0452
	(-3.52)	(-2.55)	(-2.04)	(-1.21)	(-0.98)
	[N=1962]	[N=1588]	[N=1316]	[N=1006]	[N=858]
Eastern Germany	-0.0591**	-0.0472**	-0.0595**	-0.0726**	-0.0390
	(-3.97)	(-2.54)	(-3.09)	(-3.50)	(-1.52)
	[N=2558]	[N=2074]	[N=1715]	[N=1332]	[N=1170]

Note: Heteroscedastic-consistent t-values in parentheses; **/* denote statistical significance at the 0.01 and 0.05 levels, respectively.

Source: IAB Establishment Panel, German Employment Statistics.

5. Concluding Remarks

The question whether job quality differs between newly founded and incumbent firms of the same size and whether such differences vanish over time once the new businesses mature has received surprisingly little attention so far. We provide a first empirical analysis that tackles these issues following a cohort of establishments with less than 200 employees in western and eastern Germany from 1997 to 2001. Our results indicate that start-ups are characterized by higher labor fluctuation, lower bargaining coverage and lower wages than incumbent establishments. These differences are shown to decline and become insignificant over time as the newly founded firms mature. This result implies that – at least concerning our indicators of employment quality – it takes a new firm only a few years to become an incumbent firm. The fact that this convergence is the result of market forces and not of government intervention, suggests that economic policy does not need to introduce special measures for protecting job quality in start-ups.

17 Since these estimates might be biased in various ways due to the failure (or non-reporting) of newly founded and other establishments in the panel, we made several checks using the full sample of all plants on which data were available (see Brixy et al., 2004 for details). We found that the wages paid in surviving plants do not differ significantly from those in other plants, thus confirming the result of Audretsch et al. (2001, 818) that "differentials in employee compensation are far more attributable to firm size than to whether the firm ultimately survives or fails."

In order to establish the stability and generality of our results, the analyses should be replicated with cohorts for other years, with data for other countries, and with other indicators of job quality (including subjective measures). Furthermore, it would be interesting to know more about the reasons for the initially higher labor turnover and the negative wage differential found, but these are difficult to identify and disentangle. One reason could be that newly founded firms rely more on workers that are recruited from the pool of unemployed or from out of the labor force; these may be less expensive but also less likely to survive the crucial initial period of a new employment relationship. Unfortunately we are not able to analyze this possibility since we do not have reliable information on the origin of employees in an establishment yet.

Like this, some of our other questions could be answered more precisely by tracing the employment of individuals in various (newly founded and incumbent) establishments over the years. For instance, by investigating how the wage of a given employee changes when he or she moves from an incumbent to a newly founded establishment we may be able to identify the wage differential more precisely. It would also be interesting to see how often employees in newly founded firms experience job losses, and how their wages evolve over time compared to that of similar employees that did not choose to work in a start-up. These issues point to promising areas for further research that we intend to investigate in the future.

References

Addison, J.T., Schnabel, C., Wagner, J., 2001, Works councils in Germany: their effects on establishment performance, *Oxford Economic Papers*, 53, 659-694.

Almus, Matthias, *Wachstumsdeterminanten junger Unternehmen.* Baden-Baden: Nomos, 2002.

Audretsch, D.B., van Leeuwen, G., Menkveld, B., Thurik R., 2001, Market dynamics in the Netherlands: Competition policy and the role of small firms, *International Journal of Industrial Organization*, 19, 795-821.

Barnes, Matthew, Haskel, Jonathan, 2002, *Job Creation, Job Destruction and the Contribution of Small Businesses: Evidence for UK Manufacturing.* London: Department of Economics Working Paper No. 461, Queen Mary, University of London.

Bau, Frank, 2003, *Anreizsysteme in jungen Unternehmen.* Lohmar, Köln: Eul Verlag.

Bellmann, Lutz, Düll, Herbert, Kühl, Jürgen, Lahner, Manfred, Lehmann, U.,1996, *Flexibilität von Betrieben in Deutschland.* Nürnberg: Institut für Arbeitsmarkt- und Berufsforschung der Bundesanstalt für Arbeit.

Boeri, T., Cramer, U., 1991, Betriebliche Wachstumsprozesse: Eine statistische Analyse mit der Beschäftigtenstatistik 1977-1987, *Mitteilungen aus der Arbeitsmarkt- und Berufsforschung*, 24, 70-80.

Brixy, Udo, Grotz, Reinhold, 2004, "Entry Rates, the Share of Surviving Businesses and Employment Growth: Differences between Western and Eastern Germany since Unification." In *Advances in Interdisciplinary European Entrepreneurship Research*, Michael Dowling, Jürgen Schmude, Dodo zu Knyphausen-Aufsess eds. Münster: LI.

Brixy, U., Kohaut S., 1999, Employment Growth Determinants in New Firms in Eastern Germany, *Small Business Economics*, 13, 155-170.

Brixy, Udo, Kohaut, Susanne, Schnabel, Claus, 2004, *Do newly founded firms pay lower wages? First evidence from Germany.* Nürnberg: Discussion Paper No. 28, Lehrstuhl für Arbeitsmarkt- und Regionalpolitik der Friedrich-Alexander-Universität Erlangen-Nürnberg.

Brown, Charles, Hamilton, James, Medoff, James L., 1990, *Employers Large and Small.* Cambridge, Mass., London: Harvard University Press.

Brown, C., Medoff, J.L., 2003, Firm Age and Wages, *Journal of Labor Economics*, 21, 677-697.

Brüderl, Josef, Preisendörfer, Peter, Ziegler, Rolf, 1996, *Der Erfolg neugegründeter Betriebe.* Berlin: Duncker & Humblot.

Davis, Stephen J., Haltiwanger, John C., Schuh, Scott, 1996, *Job Creation and Destruction.* Cambridge, Mass.: MIT Press.

Dunne, T., Roberts, M.J., Samuelson, L., 1989, The growth and failure of U.S. manufacturing plants, *Quarterly Journal of Economics*, 104, 671-698.

European Commission, 2001, *Employment in Europe 2001: Recent Trends and Prospects.* Luxembourg: Office for Official Publications of the European Communities.

Franz, Wolfgang, 2003, *Arbeitsmarktökonomik*, 5th ed. Berlin: Springer.

Fritsch, M., Brixy, U., 2004, The Establishment File of the German Social Insurance Statistics, *Schmollers Jahrbuch*, 124, 183-190.

Fritsch, Michael, Weyh, Antje, 2004, *How Large are the Direct Employment Effects of New Businesses? An Empirical Investigation.* Freiberg: Working Paper No. 05/2004, Fakultät für Wirtschaftswissenschaften, Technische Universität Bergakademie Freiberg.

Gerlach, Knut, Wagner, Joachim, 1997, "Analysen zur Nachfrageseite des Arbeitsmarktes mit Betriebspaneldaten aus Erhebungen der amtlichen Industriestatistik – Ein Überblick über Ansätze und Ergebnisse für niedersächsische Industriebetriebe." In *Die Nachfrageseite des Arbeitsmarktes – Ergebnisse aus Analysen mit deutschen Firmenpaneldaten*, Jürgen Kühl, Manfred Lahner, Joachim Wagner, eds. Nürnberg: Institut für Arbeitsmarkt- und Berufsforschung der Bundesanstalt für Arbeit.

Kölling, A., 2000, The IAB-Establishment Panel. Schmollers Jahrbuch, *Journal of Applied Social Science Studies*, 120, 291-300.

Kölling, Arnd, Schnabel, Claus, Wagner, Joachim, 2002, *Establishment Age and Wages: Evidence from German Linked Employer-Employee Data.* Bonn: IZA Discussion Paper No. 679, Institute for the Study of Labor (IZA).

Kohaut, S., Schnabel, C., 2003, Tarifverträge – nein danke!? Ausmaß und Einflussfaktoren der Tarifbindung west- und ostdeutscher Betriebe, *Jahrbücher für Nationalökonomie und Statistik*, 223, 312-331.

Oi, Walter Y., Idson, Todd. 1999, "Firm Size and Wages." In *Handbook of Labor Economics*, Vol. 3, Orley Ashenfelter, David Card, eds. Amsterdam: Elsevier Science.

Schmidt, Elke M., 1995, *Betriebsgröße, Beschäftigtenentwicklung und Entlohnung.* Frankfurt, New York: Campus.

Stinchcombe, Arthur L. 1965, "Social structures and organizations." In *Handbook of Organizations*, James G. March, ed. Chicago: Rand McNally.

Storey, David J., 1994, *Understanding the Small Business Sector*. London, New York: Routledge.

Turk, F., 2002, Der Mittelstand als Beschäftigungsmotor, Fakt oder Fiktion? List Forum für Wirtschafts- und Finanzpolitik, 28, 254-271.

Wagner, J., 1994, The post-entry performance of new small firms in German manufacturing industries, *Journal of Industrial Economics*, 42, 141-154.

Wagner, J. 1997, Firm Size and Job Quality: A Survey of the Evidence from Germany, *Small Business Economics*, 9, 411-425.

Wagner, J., 1999, The Life History of Cohorts of Exits from German Manufacturing, *Small Business Economics*, 13, 71-79.

7 PATENTING BEHAVIOR AND EMPLOYMENT GROWTH IN GERMAN START-UP FIRMS

A Panel Data Analysis

Michaela Niefert

1. Introduction

Innovation is universally regarded as a major source of economic growth. Correspondingly, innovation activities of firms are generally supposed to have a positive effect on firm performance. Product innovations increase demand; process innovations reduce marginal production costs. As a consequence, firms are able to conquer market shares at the expense of other firms and enhance their competitiveness. However, the time span of a competitive advantage is very short in highly competitive markets and continuous innovations are necessary to maintain a leading position. The positive relationship between innovation activities and economic performance is empirically less established at the firm level than at the macro-level.

There are quite a few studies analyzing the impact of R&D and innovations on productivity, sales, and market value at the firm level. However, despite the ongoing debate on the impact of technological change on employment, there is only relatively little microeconometric work dealing with the effect of innovations on corporate employment growth, particularly with respect to start-up firms. The sign of this effect, derived from theoretical models, is not clear: While increasing level of demand, product innovations might replace existing products and reduce price elasticity of demand so that output and employment may decrease as well; process innovations reduce production costs but often imply a labor-saving progress.

This paper empirically analyzes the relationship between innovative activity and employment growth at the micro-level using panel data on German start-up firms and patent data from the German Patent Office. It also describes the differences in entry patterns and post-entry performance following German reunification between Eastern and Western German firms and between patenting and non-patenting firms. Using fixed-effects and first-differencing panel methods, the effect of patenting activity and other potential determinants of post-entry performance is estimated.

The paper is structured as follows. The next section outlines the theoretical approaches and empirical results regarding the determinants of employment growth at the firm level while focusing on the effects of firm size, age, and innovative activity. The methodological problems encountered when analyzing the relationship between innovative activity and corporate growth as well as the econometric models used for the empirical analysis are subsequently described. A description of the underlying data set and the characteristics of Eastern and Western German start-ups as well as patenting and non-patenting start-ups follows. The last two sections present the results and the conclusion.

2. Determinants of Employment Growth

Turnover and labor costs are undoubtedly decisive factors determining level of employment. Innovations, however, are also among the most important determinants in many European economies (Blechinger et al., 1998). In contrast to the neoclassical growth theory, the theory of endogenous growth treats technological progress not as exogenously given but as a result of research and development efforts. Technological knowledge is disseminated and shared by the economy as a whole, promoting in turn economic growth. The importance which the theory of endogenous growth attaches to the production of technological knowledge for the growth process has increased interest in the microanalysis of innovation and its consequences for firm performance. Before turning to the effects of innovative activity on employment growth, however, an overview of theoretical approaches and empirical results regarding the size-growth and age-growth relationship is given.

2.1 The Effects of Firm Size and Age

The theoretical literature has paid special attention to the effect of firm size on corporate growth and to discussion of Gibrat's Law (Gibrat, 1931). According to this law, which is also called the Law of Proportionate Effect (LPE), firms grow proportionally and independently of their size. This implies that growth is independent of past growth, that growth rates are not heteroscedastic with firm size and that firm size distribution tends to become increasingly concentrated over time (Goddard et al., 2002).

Various theoretical approaches contradict Gibrat's Law. Models of optimum firm size postulate that firms converge to the minimum efficient size (MES), which varies with industry. Small firms operating below the MES have to grow to become competitive and survive. Large firms operating above the MES tend to shrink if the advantages of exploiting scale economies are outstripped by organizational problems. "Reversion-to-mean" effects and an approximation of firm sizes are then observed within industries. The need for start-up firms to grow depends on their start-up size and how prevalent scale

economies are in the industry in question. The smaller a firm's start-up size relative to the MES, the more urgent it is for the firm to grow.

The model of "noisy selection" introduced by Jovanovic (1982) explains why most firms choose a start-up size below the optimal level. This theory emphasizes managerial efficiency and learning by doing as the key factors determining firms' growth dynamics. It assumes that new firms do not know their cost function in advance, but learn about their relative efficiency as soon as they enter the market. Given the information before entry, firms might be inclined to start with a suboptimal level of output to keep sunk costs low, to expand only if subsequent performance is encouraging and to leave the market otherwise. The model implies that surviving young and small firms grow faster than older and larger ones.

Models with Penrose (1959) effects suggest that firms' current-period growth rates are constrained. According to the "managerial-limits-to-growth" hypothesis, expansion carries an opportunity cost because some existing managers have to be diverted from their current responsibilities to help manage the expansion of the management team. These costs are higher for faster growing firms. Firms, therefore, tend to smooth out their growth paths over time. Additionally, each firm is born with or develops over time certain organizational capabilities and competencies which define what the firm is capable of doing and produce a path dependence of the firm's development (Geroski, 1999). Both arguments lead to a serial correlation of growth rates over time, which is not compatible with Gibrat´s Law.

As far as the age of a firm is concerned, learn-theoretic models as proposed by Jovanovic (1982) postulate a negative relationship with firm growth. Older firms have already learned about their relative efficiency and have adapted their size accordingly – they have no need to grow. Moreover, returns from the process of learning are supposed to decrease over time, making it more and more difficult to enhance efficiency further as firms grow older. Life-cycle models explain the negative relationship by increasing saturation of the market for a firm's products (Markusen et al., 1986) and the expanding presence of competitors offering new or enhanced products (Fritsch, 1990).

There is a large body of empirical literature investigating the effects of firm size and age on corporate growth and survival. Size and age are used as control variables in virtually every study on firm performance. Empirical work focusing on start-ups mostly finds that size and age are positively related to likelihood of survival, while growth rates decrease with size and age. Thus, results correspond to Jovanovic´s model and contradict Gibrat´s Law. According to Geroski´s (1995) survey article on market entry, this "stylized result" holds independent of the country, time period, and methodology employed. Confirmations have since been made by Audretsch and Mahmood (1994) for US manufacturing, by Mata (1994) for Portuguese manufacturing, by Almus and Nerlinger (2000) for German start-ups, and by Honjo (2004) for Japanese manufacturing. Mata (1994) and Goddard et al. (2002) illustrate the impact

the particular econometric method applied has on the estimated coefficient of firm size. Mata finds evidence of unobserved, time-invariant, firm-specific effects which are positively correlated with firm size and growth. Accounting for these effects by using panel-data methods reveals an even more pronounced negative influence of firm size on growth compared to when standard cross-sectional methods are applied.

However, there is some evidence that, for firms exceeding a certain size (Becchetti and Trovato, 2002) and for those in specific sectors of the economy (Audretsch et al. 1999; Almus, 2002), growth and size are independent of one another. Lotti et al. (2001, 2003) observe a negative effect of size on growth for firms in the Italian manufacturing and instruments industry immediately following start-up. But entrants converge to random growth rates in subsequent years as they attain the MES level of output. Empirical work on the effect of age does not unanimously confirm the stylized result, either. Studies which analyze firms in infant industries or very young firms often show a positive impact of age on growth that diminishes with age (Das, 1995; Almus and Nerlinger, 1999). This suggests that the returns on learning increase at a diminishing rate during the early life-cycle stage of an industry or firm before starting to decrease as the firm or industry matures.

2.2 The Effect of Innovation Activities

The direction of the effect of innovation on employment at the firm level is theoretically ambiguous. In addition to direct effects, indirect effects depending on parameters of the production function, the respective output and labor markets and the characteristics of the innovation itself exist (Blechinger et al., 1998). Innovations can be categorized as process or product innovations. Process innovations make it possible to produce a given amount of output with less input and change the production function of the firm. They are of the labor (capital) augmenting type if they allow reduction of labor (capital) input. Product innovations comprise quality-improved products as well as new products and are supposed to affect the demand function a firm is facing.

The direct effects of process innovations involve an increase in productivity and a decrease in production costs. For a given amount of output, labor-augmenting progress will have a negative impact on employment (displacement effect). However, the decline in marginal costs tends to reduce prices and, thus, increase demand and employment (compensation effect). This indirect positive effect on employment will outweigh the direct negative effect, ceteris paribus, if demand is elastic. Furthermore, it depends positively on the elasticity of substitution between labor and capital (i.e., the degree to which the firm can substitute capital by the relatively more cost-efficient factor labor in the case of the labor-augmenting progress), on the extent of scale economies resulting from the innovation, and on the level of competition and the

corresponding degree to which cost reductions are transmitted into price reductions (Van Reenen, 1997; Blechinger et al., 1998).

The direct effect of product innovations is the generation of new demand and/or the conquest of market shares at the expense of other firms. Consequently, firms' employment demand will rise. By offering a new or quality-improved product, a firm can obtain temporary monopolistic profits until other firms are able to imitate the product or develop an even better one. However, the new product might replace existing products offered by the firm. Moreover, the novelty and uniqueness of the product might lead to a lower price elasticity of demand for the product, which entails an increase in price and a decrease in optimal output. As a consequence, the employment of the firm in question might decline (Smolny, 1998b).

The net effect of product innovations on employment depends on the relative strength of these effects. However, the positive quantity effect is more likely to prevail. In the extreme case in which specialized buyers have not previously bought the industry innovator's product, the increase in demand and output can be enormous. There is no similar effect for process innovations (Cohen and Klepper, 1996). Katsoulacos (1986) uses a theoretical analysis to derive a positive net effect of product innovations on employment; conversely, he finds the net effect of process innovations to be negative. Following these results, a negative relation between employment growth and industry age arises. In the early stages of the industry life-cycle, product innovations (i.e, the introduction of new products and further substantial product enhancements) prevail. In later stages in which the product is already largely standardized, process innovations become more important. This would imply that innovations have a positive employment effect in the early stages and a negative effect in the later stages of the industry life-cycle.

Empirical work on the effect of innovations on employment growth has yielded very mixed results. Katsoulacos' (1986) hypothesis that product innovations stimulate employment and process innovations are labor-saving has only been partly confirmed. Many studies detect a positive effect of product innovations and a negative (but often insignificant) effect of process innovations (e.g., Rottmann and Ruschinski, 1997, and Blechinger and Pfeiffer, 1999 for German manufacturing; Brouwer et al., 1993 for Dutch manufacturing; Evangelista and Savona, 2003 for Italian services). Smolny´s (1998b) analysis of Western German manufacturing firms reveals a positive effect for both kinds of innovations, but the evidence for the effect of process innovations is rather weak. Blechinger and Pfeiffer find a positive effect of product innovations only for large firms, whereas this effect is negative for some SMEs. Therefore, they caution against deriving any empirical patterns from their results. Similarly, Leo and Steiner (1995) conclude from their analysis of Austrian manufacturing firms that product innovations can increase employment in some firms and lower it in others, citing a dependence on the character of each new product (complementary or substitutional). Analyzing data from the

Community Innovation Survey (CIS) for several European countries, Blechinger et al. (1998) observe a positive employment effect of R&D commitment in German, Danish, Belgian and Italian manufacturing firms. Given the total amount of R&D, a high share of R&D directed toward process innovations significantly decreases employment in German firms. However, the reverse effect can be found in Luxembourg and Italy. Further evidence in favor of a positive effect of process innovations on employment growth is presented by Doms et al. (1994) for US manufacturing plants and by Klomp and Van Leeuwen (2001) for Dutch firms, most of which were involved in the manufacturing sector at the time. Surprisingly, Klomp and Van Leeuwen simultaneously detect a negative effect of the share of innovative products on employment growth. Recent studies by Jaumandreu (2003) and Peters (2004) using CIS data on Spanish and German manufacturing and service firms, respectively, find that product innovations increase employment growth and that the magnitude of the effect corresponds approximately to the increase in innovative sales. In addition, Peters' results reveal that this holds for firm novelties as much as for market novelties. As far as process innovations are concerned, Jaumandreu does not observe any significant negative impact with respect to employment. Peters can only detect such an effect for manufacturing firms which have carried out only process innovations and have introduced a new production technology for rationalization reasons (and not in order to improve product quality or fulfill legal requirements). She argues that the varying effects of different types of process innovations may explain the contradicting empirical evidence concerning the effect of process innovations on employment growth.

Of the studies cited above, those by Das (1995), Goddard et al. (2002), Mata (1994) and Rottmann and Ruschinski (1997) apply panel-data techniques (fixed-effects or random-effects models) based on annual growth rates; Smolny performs pooled OLS regressions. All of the other studies use cross-sectional methods and calculated growth rates for the most part over several years in order to avoid short-term fluctuations. There are only two studies known to the author which – like this analysis – use patents as an innovation indicator and apply panel-data techniques in their analysis of employment growth at the firm level. Van Reenen (1997) uses Arellano and Bond's first-differencing model for UK manufacturing firm data and finds a positive relationship between number of successful innovations[1] and level of employment two or three periods later; the effect of product innovations is stronger than that of process innovations. The number of patents taken out in the US, however, has a positive but insignificant effect when number of innovations is controlled for. Using a fixed-effects model, Greenalgh et al. (2001) discover that R&D intensity as well as UK patent publications have a positive impact on employment level in British industrial and commercial companies. Instead

1 "Successful innovation" here means the successful commercial introduction of new or improved products or processes.

of patent counts, they use a weighted average of patents published between two and four years prior to the employment observation, with weights reflecting the average rate of patent renewals. Like Van Reenen (1997), they are unable to find a positive impact of US patents on employment and conclude that patents in the respective domestic market, rather than US patents, have a significant value to UK firms.

Only little empirical work on the effect of innovative activity on the post-entry performance of start-ups exists. Some studies compare the growth chances of young firms in high-tech and low-tech industries without considering the innovative behavior of the individual firm. They all find the growth rates of start-ups to be higher in technology-intensive sectors of the economy (Kirchhoff and Phillips, 1989; Almus and Nerlinger, 1999; Audretsch, 1995). Tether (1997) derives some stylized facts regarding mean employment creation in innovative and technology-based new and small firms: Controlling for size and age, innovative and technology-based firms significantly outperform firms from the general population in terms of rate of job creation, but the mean rates of direct employment creation in these firms are only modest. Moreover, the distribution of the rates of job creation is highly skewed, i.e., the bulk of jobs are created by a small subset of the total population of innovative and technology-based new and small firms.

There is hardly any empirical literature, however, on the effect of innovative activities on post-entry performance at the firm level. One exception is a paper by Hsueh and Tu (2004), who use data on a cross-section of new Taiwanese SMEs to investigate the impact of various innovation indicators on sales growth and profit rates. According to their results, the cultivation of an innovative atmosphere and of the capability to innovate enhances both performance measures, especially profits. Sales growth is more strongly fostered by innovative actions like R&D, process innovations, moving into new business areas and using new marketing channels.

The lack of empirical research on the effects innovative activity has on the success of entrants is surprising. It is widely recognized that new firms play a decisive role in the innovation process. Start-ups are often founded in order to introduce new innovations into the market. It is also well known that innovations attract imitators, causing the competitive advantage emanating from an innovation to disappear in the long run. In order to be successful in the market, start-ups have to constantly implement innovations. The contribution of this paper is its investigation of the impact of innovative behavior on post-entry performance over the first years of firms' life-cycles. Employment growth is used as a performance measure, and patent applications are utilized as an indicator of innovation.

3. Methodological Issues

There are several methodological problems associated with the empirical analysis of how innovative activity affects employment growth. Firstly, the evolution of employment size is determined by many factors. All of these have to be controlled for in order to isolate the specific contribution of a certain variable. However, not all the determinant factors are observed – there is unobserved heterogeneity. If these unobserved effects are correlated with the observed explanatory variables in the model, the estimated coefficients will be biased. For example, innovative firms often have unobserved comparative advantages in implementing new technologies or possess special strategic competencies. If employment growth in these firms is driven by these unobserved factors, the effect of innovation per se will be overestimated unless one controls for unobserved heterogeneity. Panel-data models accounting for unobserved, time-constant individual effects may help to overcome this problem.

Secondly, the data set used might be a non-random sample of the whole population of firms, allowing the estimation to be affected by selection bias. With panel data, this problem becomes aggravated in the presence of panel attrition, i.e., if some firms drop out of the panel after a period of time. If the selection mechanism is non-random but systematically related to the response variable after conditioning on explanatory variables, the estimated coefficients might be biased. In the present case, in which only surviving firms enter the estimation procedure, such a systematic relation is very likely to exist because the growth and survival of firms can be supposed to be partially influenced by the same unobserved factors. If these unobserved factors are correlated with those observed, failure to control for them will lead to erroneous inference regarding the impact of the observables on the dependent variable. For example, it has been claimed that the negative relationship between size and growth revealed by many empirical studies is actually due to failing to account for survival bias (Mansfield, 1962). Unobserved factors correlated with small firm size influence survival as well as growth negatively. The early exit of small firms with minor growth rates leads to an overly positive picture of small firms' growth performance and a false rejection of Gibrat's Law. As long as the probability of being in the sample is constant over time, consistent estimates can be obtained from fixed-effects or first-differencing panel-data methods. However, if selection varies over time and is correlated with the error term of the structural equation of interest, special methods correcting for selection bias have to be applied.

Further attention should be devoted to the possible endogeneity of innovative activity as a determinant of employment growth. If the innovation indicators themselves are affected by growth, econometric methods allowing for endogenous explanatory variables have to be used. Generally, one might expect a two-way relationship between R&D, innovation activities and perform-

ance at the firm level: A firm's innovativeness is an important determinant of its performance in the subsequent period, but its current performance may also control its future innovative effort. This is plausible for performance measures such as cash flow or sales, which are closely connected to the liquidity of a firm and, thereby, determine its ability to finance innovation activities. It may also apply to employment growth, which can be considered as a proxy for the demand expectations of a firm. In order to capture a greater part of the growing market, a firm might decide to undertake innovative efforts. However, firms can directly influence only the inputs into the innovation process. Throughput and output indicators (patents, innovations) cannot be planned exactly since they involve R&D efforts with long gestation periods and uncertain success (Van Reenen, 1997). A priori, it is not clear whether one can assume innovations to be predetermined or must consider them as endogenous with respect to employment growth. In their specification of an empirical model based on the innovation model of Kline and Rosenberg (1986), Klomp and Van Leeuwen (2001) preclude any influence of employment growth on innovation by allowing for a feedback loop proceeding only from sales growth to innovation output. There is no study known to the author which documents the effect of employment growth effect on innovations. Performing a Granger causality test, Lööf and Heshmati (2004) cannot detect any significant impact of employment growth on R&D intensity.

Another problem is presented by the appropriate measurement of employment and innovation activity. Regarding employment, simply using number of employees might be misleading. Firstly, if labor-saving progress, for example, is implemented by a reduction of hours worked instead of a reduction of number of employees, the effect of technical progress on employment will be underestimated (Blechinger et al., 1998). Hence, it is preferable to use number of hours worked. Secondly, innovations may affect various skill levels of employment very differently. There is usually a complementarity between new technology and skilled labor; this causes the demand for skilled labor to rise with technical progress while the demand for unskilled labor declines (Blechinger et al., 1998). It is therefore desirable to have employment data distinguishing the skills required to do each individual job. Unfortunately, no information on hours worked or skills was available for this study.

Different indicators have been used to measure innovative activity. There are input-oriented indicators like share of R&D personnel in total personnel or R&D expenditures per employee, as well as output-oriented measures such as innovation counts, self-reported statements on innovations or share of turnover attributable to innovations. Measures also exist which have been referred to as an intermediate result of the production process or a throughput indicator of innovation (Licht and Zoz, 1996; Blechinger et al., 1998), namely number of patent applications or grants. On the one hand, patents are inventions and insofar the output of research activity. A patent application indicates that R&D efforts have been productive and have led to an invention which the en-

terprise considers to be worth protecting. On the other hand, patents have to be combined with information on manufacturability and user needs in order to be implemented in the production process or converted into a marketable product. They can, thus, be seen as an input factor for innovations which at the same time enable firms to exert property rights and appropriate profits from their ideas.

Of these measures, the one most suitable for empirical analysis depends on the research topic. If the effect of innovative activity on employment is to be analyzed, output-oriented indicators incorporating economic success - and thus the respective demand situation - should be preferred, since a firm's employment decision depends heavily on demand (Blechinger et al., 1998). In this study, such indicators were not available for the underlying data set. For patents (which have been used instead) the link to economic success is not as strong. Like all input and throughput indicators of innovation, they affect productivity and output after a delay. The underlying inventions first have to be converted into new production techniques or marketable products. New capital equipment, training or even further R&D might be necessary. Moreover, patents can be regarded as real options guaranteeing exclusive rights which allow firms to hold off on the conversion into innovations. When facing uncertain market conditions, firms might prefer to delay these investments, which are at least partly irreversible (Bloom and van Reenen, 2002). Hence, the length of time before patents affect firm performance depends on the quantity and quality of the necessary investments and on market conditions.

Furthermore, the patent indicator is beset with three fundamental problems: First, not all inventions are patentable; second, not all patentable inventions are patented; and third, patented inventions differ greatly in quality (Griliches, 1990). As to the first point, there are some kinds of technical progress, e.g., imitative or incremental innovations, which are too small or too applied in nature to be patentable. Still, they represent an increasingly important part of innovative activity and may affect firm performance (Licht and Zoz, 1996). Referring to the second point, it is clear that patents are only one way of protecting an innovation and not always the most effective one. In some cases, other mechanisms like secrecy, lead time or long-term employment contracts are better suited to appropriate returns on R&D. Patents disclose at least some information to competitors via patent documents and can play an important role in information diffusion (Cohen et al., 2002). The inclination to use patents for innovation protection is supposed to depend on the industry and type of innovation involved. Patents are a more efficient protection mechanism for product than for process innovations (König and Licht, 1995). For process innovations, secrecy is a more effective instrument of avoiding imitation. The last point refers to the fact that some patents reflect important inventions leading to successful innovations, while others have almost no economic significance and are not converted into innovations. Accordingly,

some patents improve firm performance and others do not. This makes it difficult to estimate the average effect precisely.

Finally, it is not likely that the effect of innovative activity – no matter how it is measured – will be restricted to one time interval. It is likely distributed over several delays, as it takes some time for a firm to fully adapt its production to the new technique/product in question. This makes it difficult to estimate the overall impact of innovation. Furthermore, only the effects of the proceeds of innovating (involving either a product or process) have been addressed thus far. However, the process of innovating will increase a firm's ability to appropriate knowledge contained in other firms' innovations and will improve its general competitiveness. Therefore, innovating firms can be assumed to perform generally better than their non-innovating counterparts (Geroski et al., 1993).

4. Econometric Model

The empirical analysis is based on a model which has commonly been used as a starting point for testing Gibrat's Law:

$$y_{it} - y_{i,t-1} = \alpha_i + \beta y_{i,t-1} + u_{it}; \qquad u_{it} = \rho u_{i,t-1} + e_{it}.$$

The dependent variable is the logarithmic employment growth rate with y_{it} being the logarithm of employment of firm i in period t. u_{it} is an error term. β determines the relationship between logarithmic firm size and logarithmic firm growth. $\beta=0$ implies that employment grows independently of firm size, the case described by Gibrat's Law. Further, if $\rho = 0$, growth follows a random walk, which is another implication of the law. Departures from the law arise if either $\beta \neq 0$ (with $\beta>0$ implying explosive growth rates, and $\beta<0$ implying mean-reverting firm sizes) or $\rho \neq 0$ (with $\rho>0$ implying that above-average growth tends to persist, whereas for $\rho<0$ such growth tends to be followed by below-average growth).

Equation 1 is estimated using fixed-effects and first-differencing methods. According to a reparameterization of the model suggested by Goddard et al. (2002)[2], lagged employment growth is included as an additional regressor. Moreover, following Evans (1987a,b), the logarithm of firm age and the second-order expansion of logarithmic size and age are added. Legal form and indicators of current and past patenting activity are included, as well. While the fixed-effects model assumes the error term u_{it} to be homoscedastic and serially uncorrelated, the first-differencing model implies that u_{it} follows a random walk (Wooldridge, 2002). The relative efficiency of the fixed-effects and first-differencing methods depends on the appropriateness of their assumption concerning the time-series properties of u_{it}. In addition to the standard within

2 Goddard derives the following reparameterization:
$y_{it} - y_{i,t-1} = \alpha_i(1-\rho) + \beta y_{i,t-1} + \rho(y_{i,t-1} - y_{i,t-2}) + \eta_{it}$ with $\eta_{it} = e_{it} + \rho\beta y_{i,t-2}$.

estimator, a fixed-effects model where the error term u_{it} is assumed to follow a first-order autoregressive process is estimated. The first-differencing model is estimated by 2SLS using lagged values of $y_{i,t-1}$ as instruments for the lagged dependent variable on the right-hand side. The first-differencing method is more appropriate than the fixed-effects approach if no exogenous instruments are available, as in this case (Wooldridge, 2002). Nevertheless, according to Goddard et al. (2002), the fixed-effects model is adequate to test Gibrat's Law and is in any case preferable to cross-sectional tests due to its important advantage of accounting for heterogeneity. It will therefore be used as a standard of reference in this study.

The first-differencing model is also appropriate for coping with the possible non-randomness of the sample. Selection bias could be caused by the temporary (incidental truncation) or permanent drop-out (attrition) of units observed in the data. The permanent drop-outs are often due to firm closure, which, as stated above, should be influenced by the same unobserved factors as growth. However, firms dropping out for other reasons may also exhibit unobserved characteristics affecting employment growth. In order to eliminate attrition bias, an extension of Heckman's (1979) two-step selection correction procedure to the panel-data context as described in Wooldridge (2002) is used.[3]

5. Description of Data

The empirical analysis is based on a sample of German firms founded between 1990 and 1993. The impetus behind the creation of this data set was to research the foundation activities and post-entry performance of Eastern and Western German firms immediately following German reunification. For the configuration of the sample, a stratified sample of 12,000 firms was drawn from the ZEW Foundation Panels, two complementary firm panels maintained by the Centre for European Economic Research (ZEW), Mannheim (see Almus et al., 2000 for details). The firm data were provided by Creditreform, the largest credit agency in Germany, which collects information on

3 Let S_{it} denote a selection indicator where $S_{it}=1$ if firm i is observed in t and $S_{it}=0$ if it is missing due to permanent drop-out. S_{it} is only set to zero in the period immediately following a unit's departure from the sample. In later periods, these units will be ignored. The first step consists of a probit estimation of the selection equation

$$s_{it} = 1(w_{it}\delta_t + v_{it} > 0), \qquad v_{it} \left| \{w_{it}, s_{i,t-1} = 1\} \sim \text{Normal}(0,1) \right.$$

for each $t \geq 2$. w_{it} should contain all regressors of the structural equation to avoid exclusion restrictions on a reduced-form equation. Moreover, it should include at least one significant explanatory variable which is not part of the structural equation. Inverse Mills ratios $\hat{\lambda}_{it}$ are calculated for each of the *T-1* probit estimations. In the second step, these are included in Equation 1, yielding $y_{it} - y_{i,t-1} = \alpha_i + \beta y_{i,t-1} + \rho_2 d2_t \hat{\lambda}_{it} + \ldots + \rho_T dT_t \hat{\lambda}_{it} + u_{it}$

where $d2_t$ through dT_t are time dummies. Attrition bias can be tested by a joint test of $H_0: \rho_t = 0$ for $t = 2, \ldots, T$.

active, legally independent firms. The data contain information on variables like industry, legal status, foundation date, region, and founding parties' human capital. They comprise virtually all Eastern and Western German firms found in the trade register. The probability of unregistered firms entering the panel depends on the scope of their credit demand and of their business relationships with other firms.

The sample drawn from the foundation panels is stratified by region: It consists of two pools of 6,000 firms each from Eastern and Western Germany, respectively. An indicator demonstrating whether each firm had possibly exited the market was applied as a further stratification criterion. Such firms were over sampled in order to counterbalance the probable positive selection encountered in enterprise panels, which results from the difficulty of contacting agents of non-surviving firms and from their unwillingness to report failure. The sample is confined to firms founded between 1990 and 1997 (more than 90 percent were founded between 1990 and 1993) in the manufacturing, construction, trade, transport and communication, and service sectors. A large telephone survey conducted in 1999 and 2000 provided information not contained in the foundation panels, e.g., annual number of employees and exact date of firm closure. The survey ended up with 3,702 successfully interviewed firms.[4] For the larger part of this study's analysis, legally dependent firms, firms which were not truly new foundations but takeovers, those that submitted a foundation year earlier than 1990 in the telephone interview, and those belonging to sectors of the economy in which patents have no relevance (transport and communication, retail trade, and consumption-related services)[5] have not been included. Furthermore, firms with an average employee base of more than 500 employees and firms for which no employment figures were obtained have been excluded. Firms with implausibly high average growth rates have also been dropped. In the end, 1,387 firms remain for the analysis. Annual growth rates can be calculated from the foundation year up until 1999 or the respective year of closure.

5.1 Comparison of Eastern and Western German Firms

Table 7.1 contains some descriptive results for the start-up firms, differentiated by region. It shows that 60 percent of the firms in the sample are situated in Eastern Germany. This disproportionately large share stems from the Eastern German firms' higher rate of response to the survey. This in turn can be explained by a certain surfeit of surveys in the West which is not yet that prevalent in the East. The distribution by sector reveals an above average share of construction start-ups in Eastern Germany. It reflects the (govern-

4 The survey is called „ZEW-Gründerstudie" and is described in detail in Almus et al. (2001).

5 In the communication/transporting and consumption-related service sectors, not a single patent was applied for during the observation period; in the retail trade sector only one patent application was filed.

ment-subsidized) boom which resulted from the immense need for reconstruction and development of buildings after the German reunification. There are comparatively few foundations in business-related services in the East, indicating that the traditional economic structure characterized by a strong industry sector still prevails. The transition to a more service-oriented modern economy has taken place rather slowly. One reason for this might be the lack of highly qualified people particularly vital to this branch.

Table 7.1: Descriptive statistics for Eastern and Western German firms

	All Firms	Eastern German firms	Western German firms
Number of firms	1,387	832 (60.0%)	555 (40.0%)
Firms by sector (%)			
manufacturing	*22.4*	*22.5*	*22.3*
construction	34.5	41.9	23.2***
wholesale & intermediate trade	19.0	16.6	22.5***
business-related services	24.2	19.0	31.9***
Mean annual growth rate	12.7	14.3	10.4**
Surviving firms (%)	73.3	74.0	72.1
Mean employment size	16.6	21.1	9.8***
Average capital at foundation (DM)	706,117	1003,890	271,778
Average owner capital at foundation (DM)	150,658	153,909	145,889
Public start-up assistance (%)	32.3	41.0	16.6***
Firms by earliest legal form (%)[6]			
ltd. liability company	58.0	55.3	62.0**
civil law association	10.6	10.7	10.5
commercial partnership	1.4	1.6	1.3
sole proprietorship	29.9	32.2	26.3**
Founder education, highest level (%)			
doctorate	2.9	2.4	3.8
other academic degree	30.3	33.1	26.1***
master craftsman	15.8	15.6	16.0
apprenticeship	26.2	18.5	37.7***
low education	0.8	0.6	1.1
education unknown	24.0	29.8	15.3***
Year of foundation (%)			
1990	26.7	26.7	26.8
1991	24.4	25.5	22.9
1992	21.8	23.0	20.0
1993	19.2	17.2	22.2**
after 1993	7.9	7.6	8.3

*** (**,*) indicates a significance level of 1% (5%, 10%) in a two-tailed t-test on the equality of means.

6 The legal form of the remaining non-patenting firms is unknown. There are no stock companies in the sample.

Eastern German firms exhibit significantly higher employment growth rates than Western German firms. This reflects the higher growth potential of a transition economy as compared to an established market economy. Eastern German firms are about twice as large on average as their Western German counterparts and dispose of almost four times as much capital during foundation. This has to be seen in the context of a substantially higher share of Eastern German firms receiving public start-up assistance and more favorable conditions of East-oriented financing programs, indicating that federal subsidization policies after reunification concentrated mainly on Eastern Germany.[7] The average size of loans given to Eastern German start-ups dwarfs that of Western German firm foundations by 90 percent. The larger average employment size of Eastern German firms is somehow contradictory to their comparatively high share of sole-proprietorship firms. However, this can partly be explained by the fact that the response rate of start-ups founded in this legal form is not as disproportionately low for Eastern German firms as for those in Western Germany (Almus et al., 2001).

The distribution by education indicates that Eastern German founders are more highly educated than firm founders in the West. However, this result has to be interpreted with caution since the degrees of educational attainment in Western Germany and the former German Democratic Republic are not directly comparable. The high non-response rate of Eastern German firms to this question might reflect an awareness of this incongruity.

Finally, the table indicates that foundation rates were largest immediately after the collapse of the German Democratic Republic and constantly declined in Eastern Germany from 1990 on. The early start-up cohorts were probably able to realize first-mover advantages from reacting quickly to the changing political and economic conditions. A similar pattern can be observed in Western Germany, where firms benefited from the reunification-related boom. It should be noted, however, that the response rate of the 1990 cohort was slightly higher than that of the 1993 cohort (Almus et al., 2001).

5.2 Comparison of Patenting and Non-Patenting Firms

The firm data set has been merged with German patent data by a text field analysis of the firm names. Each attribution of a patent to a firm made by the software program was checked by hand by comparing the exact names and addresses of both data sets. The data basis of the following analysis can therefore be considered reliable.

The patent data contain information on patent number, year of application, IPC code, an indicator of whether the application was made at the European Patent Office (EPO), year of acceptance, and number of citations. The combi-

7 The information on receipt of start-up assistance was obtained from the former *Deutsche Ausgleichsbank (DtA),* the second largest public bank in Germany. For a detailed description of the start-up assistance programs see Prantl (2002).

nation of the two data sets allows an analysis of the relation between innovative activity and employment growth. In the following, some descriptive findings from examinations of the merged data set are depicted.

Only 44 (3.2 percent) of the 1,357 firms applied for one or more patents between 1990 and 1999 (see table 7.2). All told, the sampled firms made 128 patent applications in that period, 21 (16.4 percent) of which were applied for at the EPO and 56 (43.8 percent) of which were granted up to the year 2003.[8] The distribution by economic sector reveals that half of the patent applications come from the manufacturing sector. This explains why the empirical literature concerning patents has focused primarily on this sector. There is, however, considerable patenting activity in business-related services as well; over a third of all patents stem from this sector. The rest come from the wholesale and intermediate trade sector and – to a very small extent – from construction.

As a comparison with the sectoral distribution of patenting firms shows, the sectors obviously differ by their mean numbers of applied-for patents. The share of manufacturing firms in patenting firms is somewhat higher than that of manufacturing-related patent applications in all applications: The mean number of applications by patenting firm is, hence, lower than average in manufacturing. In contrast, the share of business-related service firms in patenting firms is smaller than the share of applications attributable to this sector in all applications. Consequently, the mean number of patent applications per patenting firm is higher than average in business-related services. The share of patent applications from both manufacturing and business-related services far exceeds the weight of these sectors – as measured by the number of firms found in each – in the economy. The opposite holds for wholesale and intermediate trade and, in particular, construction. Overall, the distribution of patent applications across patenting firms is highly skewed. 43 percent of all patenting firms only applied for one patent within the given period; a quarter of them applied for two patents. However, only about 5 percent of the patenting firms applied for more than ten patents, thereby accounting for more than a quarter of the total number of patent applications.

Average annual employment growth rates apparently do not significantly differ between patenting and non-patenting firms. This result contrasts with one of the stylized facts found by Tether (1997), according to which innovative firms outperform other firms in terms of job creation. Even taking into account that patenting behavior is not a perfect indicator of innovativeness, this difference is striking. Further analysis shows that the share of firms exhibiting growth rates near the outer edge of the distribution is higher among patenting than among non-patenting firms. Patenting firms more often evince growth rates above the sample's upper quartile, but also exhibit declining em-

8 The relatively low percentage of granted patents may be due to the fact that the patent data are still incomplete for the year 2000 and after. The fraction of granted patents may, therefore, be underestimated for patent applications from the late 1990s.

ployment more often than their non-patenting counterparts. For the latter, growth rates close to zero are observed more often.

Table 7.2 further indicates that patenting firms have a higher probability of survival than their non-patenting counterparts. However, the difference is only slightly significant. Average employment size (the average of the annual employment figures available for each firm) is more than twice as large for patenting firms as for non-patenting ones. The amount of seed capital utilized by patenting firms is several times larger than that disposed of by non-patenting start-ups. Half of the patenting firms received start-up assistance compared to only a third of the non-patenting companies, and the average loan size of the former group is three times larger. This reflects a "picking the winner" strategy of capital lenders, who obviously consider innovative firms to have higher chances of success.

The mean age of patenting firms at the time of patent application is slightly lower than their mean age over the observation period, suggesting that firms rather exhibit patenting activity at a relatively early stage in the life cycle. Patenting firms are mostly founded in the legal form of limited liability companies, something which is less common among non-patenting firms; the latter are more often sole proprietorships. Firms engaging in patent activity are more often situated in the western part of Germany than non-patenting firms. Comparing firm founders' highest level of education shows that founders of patenting firms possess doctorate degrees more often than those of non-patenting companies. Somewhat surprisingly, they do not have other academic degrees more often.

Finally, the distribution of patenting firms across federal states is depicted in table 7.3 and is compared to the distribution of all firms. The table refers to the complete sample of successfully interviewed firms (n=3702) and displays the distribution separately for Eastern and Western Germany. Otherwise, the results would be heavily biased because of the higher response rate of Eastern German start-ups.

In Western Germany, most patenting start-ups are situated in North Rhine-Westphalia and Bavaria. This cannot just be explained by the large size of these states because their share in patenting start-ups surmounts their share in all start-ups; in other words, the share of start-ups exhibiting patenting activity in all start-ups in these states is higher than in other states. Relatively low (or even non-existent) shares of young, patenting firms can be observed in the northern states Schleswig-Holstein, Bremen, Hamburg, Lower Saxony and West Berlin. In Eastern Germany, disproportionately high shares of patenting start-ups are present in Saxony and Thuringia. In contrast, shares are relatively low in Mecklenburg-Western Pomerania and Saxony-Anhalt. In order to compare the innovativeness of Eastern and Western German start-ups, the share of patenting start-ups in all start-ups was calculated for each region. It stands at 2.1 percent in the East and at 2.7 percent in the West. It is higher in several Eastern states than in some Western states.

Table 7.2: Descriptive statistics for patenting and non-patenting firms

	All Firms	Non-Patenting Firms	Patenting Firms
Number of firms	1,387	1313 (96.8%)	44 (3.2%)
No. of patent applications	128.0	-	128.0
No. of EPO patent applications	21.0	-	21.0
No. of granted patents	56.0	-	56.0
Patents by sector (%)			
manufacturing	49.2	-	49.2
construction	1.5	-	1.5
wholesale & intermediate trade	12.9	-	12.9
business-related services	36.4	-	36.4
Firms by sector (%)			
manufacturing	22.4	21.2	59.1***
construction	34.5	35.5	4.6***
wholesale & intermediate trade	19.0	19.1	13.6
business-related services	24.2	24.2	22.7
Mean annual growth rate	12.7	12.7	11.8
Surviving firms (%)	73.3	72.9	84.1*
Mean employment size	16.6	15.9	37.9***
Average capital at foundation (DM)	706,117	403,945	8897,432***
Average owner capital at foundation (DM)	150,658	138,995	487,571**
Public start-up assistance (%)	32.3	31.9	48.8**
Mean firm age	3.3	3.3	3.5
Mean firm age at patent application	-	-	3.0
Firms by earliest legal form (%)[9]			
Ltd. liability company	58.0	57.3	79.6***
Civil law association	10.6	10.7	6.8
Commercial partnership	1.4	1.5	0.0
Sole proprietorship	29.9	30.4	13.6**
Western Germany (%)	40.0	39.6	52.3*
Founder education, highest level (%)			
doctorate	2.9	2.8	9.1**
other academic degree	30.3	30.3	29.6
master craftsman	15.8	15.9	13.6
apprenticeship	26.2	26.1	27.3
low education	0.8	0.8	0.0
education unknown	24.0	24.1	20.4

*** (**,*) indicates a significance level of 1% (5%, 10%) in a two-tailed t-test on the equality of means.

9 The legal form of the remaining non-patenting firms is unknown. There are no stock companies in the sample.

Table 7.3: Distribution of (patenting) start-ups across Federal States (%)

	Patenting start-ups	All start-ups	Share of patenting start-ups in all start-ups
Schleswig-Holstein	2.2	3.5	1.7
Hamburg	0.0	1.6	0.0
Lower Saxony	6.7	10.3	1.7
Bremen	0.0	0.8	0.0
North Rhine-Westphalia	37.8	30.0	3.4
Hesse	4.4	9.7	1.2
Rhineland-Palatinate	2.2	5.5	1.1
Baden-Wuerttemberg	13.3	14.0	2.6
Bavaria	31.1	20.3	4.1
Saarland	2.2	2.2	2.7
Berlin (West)	0.0	2.1	0.0
Total/mean	100	100	2.7
Berlin (East)	2.3	4.1	1.2
Brandenburg	20.9	17.6	2.5
Mecklenburg-Western Pomerania	2.3	12.4	0.4
Saxony	41.9	29.8	3.0
Saxony-Anhalt	7.0	16.1	0.9
Thuringia	25.6	20.0	2.7
Total/mean	100.0	100.0	2.1

These numbers do not correspond to official patent statistics concerning general patenting intensity in Germany's federal states. According to these statistics (Greif und Schmiedl, 2002), number of patent applications per employee is largest in Baden-Wurttemberg, Bavaria, and Hesse. This figure is always higher for Western states. Thus, it can be concluded that the regional distribution of patenting intensity differs between established and start-up firms. In particular, while patenting activity in the East is substantially lower than in the West in general, it is only slightly lower in start-ups.

6. Empirical Results

The econometric analysis incorporates the estimation of an employment growth equation using fixed-effects as well as first-differencing methods. The names and definitions of the explanatory variables are given in table 7.4. The analysis is based on an extended version of Equation 1 as described above. Patenting activity is measured by a variable indicating whether each firm applied for any patents during the year of observation, by number of patent applications, or by patent stock. The first two indicators are included with two

lags in order to account for the delay with which patenting behavior may affect employment. The patent stock is a weighted index of the number of current-period and past patent applications. It is based on a standard perpetual-inventory equation with constant depreciation:

$$pat\_stock_{it} = (1-\delta)pat\_stock_{i,t-1} + numb\_pat_t ,$$

where the depreciation rate δ is chosen to be 15 percent (Griliches and Mairesse, 1984; Czarnitzki and Kraft, 2004). Thus, the older the patent application the smaller the weight attributed to it in the patent stock. On the one hand, the use of a patent stock measure has the advantage of avoiding the problem of long lag structures. The coefficients of the other patent indicators' different lags may be estimated somewhat imprecisely because of the correlation of a firm's patenting behavior over time. On the other hand, the patent stock measure presumes a specific lag structure and does not allow the relative impacts of different lags to vary. An interaction term involving patent stock and age is included to test whether the effect of patenting activity varies over each firm's life cycle. The patenting indicators are not instrumented, as they turn out to be exogenous in Granger causality tests. The test's conclusion corresponds to the theoretical modeling and empirical evidence concerning employment growth and innovative activity as cited in the methodological section.

Table 7.4: Variable definitions

Variable name	Variable description
Δ employment	logarithmic employment growth
employment	log of employment
age	log of firm age
empl*age	interaction between log of employment and log of firm age
ltd_ liability	limited liability company
numb_pat	number of patent applications in current period
patent	indicator taking value 1 if firm applied for at least one patent in current period, 0 otherwise
pat_stock	weighted index of number of current and past patent applications
pat_stock*age	interaction between patent stock and log of firm age
attr_dead	leading selection indicator taking value 1 if firm leaves the panel due to firm closure in subsequent period, 0 otherwise
attr_perm	leading selection indicator taking value 1 if firm leaves the panel permanently for reasons other than closure in subsequent period, 0 otherwise
att_temp	leading selection indicator taking value 1 if firm leaves the panel temporarily in subsequent period, 0 otherwise
mills 93-99	inverse Mills ratios estimated from probit regressions (equation 5)

In addition, indicator variables of either possible selection bias or selection correction terms are included in the regressions. Three indicators of selection

bias specify whether a firm is missing in the subsequent period because of permanent drop-out due to firm closure, permanent drop-out due to other reasons or temporary drop-out, respectively. Using them in the regression allows only testing for selectivity. In order to correct it, the Heckman procedure is applied and Mills ratios are inserted as correction terms.

Table 7.5 shows the estimation results using four different econometric approaches with employment growth as the dependent variable. The right-hand side variables are displayed in the first column. The second column contains the estimated coefficients of the fixed-effects model. The results in the third column are based upon a fixed-effects model in which the error term is assumed to follow a first-order autoregressive process. The 2SLS results of the first-differencing model without selection correction using lagged values of $y_{i,t-1}$ as instruments are given in the fourth column. The last column shows the corresponding 2SLS results with selection correction.[10]

The outstanding difference between the fixed-effects models with and without serial dependence in the disturbances is the direction of the effect of employment growth, lagged by one period. While this effect is positive in the normal fixed-effects model, it is negative in the fixed-effects model allowing for autocorrelated disturbances. This could be explained as follows: Even when controlling for time-constant, firm-specific effects, individual growth rates are positively correlated over time. This correlation might be due to firms smoothing out their growth rates over time - as suggested by Penrose - to a specific economic situation lasting several periods or to a firm's temporary competitive advantage. When controlling for such effects using autocorrelated errors, the effect of the past growth rate itself is negative, which can be ascribed to oscillatory movements of growth rates measured on an annual basis. Hence, the fixed-effects model with autocorrelated disturbances, which allows differentiation between these opposite effects, is clearly preferable to the normal fixed-effects model. Still, it should be remembered that the inclusion of the lagged dependent variable in a fixed-effects regression leads to estimation bias. In this respect the first-differencing method with which lagged growth and lagged employment size are instrumented by their past values is more reliable; it also allows for serial correlation of the error term in the form of a random walk. The two first-difference estimations in table 7.5 do not reveal any significant effects of past growth on current growth.

However, even if the growth process is not path-dependent, Gibrat's Law can clearly be rejected on the basis of the results in table 7.5: All four estima-

10 Number of observations and number of firms are lower in the fixed-effects model with autocorrelated errors than in the normal fixed-effects model because the maximum number of observations per firm available for estimation is lower in the former. One observation per firm is needed for the estimation of the autocorrelation coefficient which cannot be used for the growth regression. Number of observations is even lower in the first-differencing model because two observations are needed to generate the instruments for the lagged dependent variable.

tions show a highly significant negative effect of previous firm size on current growth, although the positive sign of the quadratic term – which is significant in the first-differencing models – indicates that this negative effect diminishes with size. The turning point at which the negative effect turns positive, however, is much higher than the maximum employment size ever reached by firms in the sample during the observation period. Thus, small firms clearly grow faster than their larger counterparts. Employment growth is not a random process independent of firm size. The fixed-effects models indicate further that the negative effect of firm size on growth becomes more pronounced as firms get older. This can be concluded from the coefficient of the interaction term between size and age. However, this effect is not confirmed by the first-differencing models.

Firm age has a significant positive effect on growth. This result is inconsistent with many empirical studies which find a negative relationship between age and growth; this can be explained by the fact that the present data set contains only start-up firms. The propensity to grow may actually be quite low shortly after firm formation, when a firm has yet to learn about its efficiency relative to its competitors. The more it learns and discovers that it operates efficiently, the more likely it is to decide to stay in the market and grow. In addition, returns on learning might be increasing in such early stages of the life cycle. The results are in line with other studies based on start-up samples which find a positive effect of age on growth that turns negative after a few years (Almus and Nerlinger, 1999; Almus et al., 1999). However, evidence for the existence of a turning point at which the effect becomes negative can only be found in the fixed-effects models.

Legal status affects employment growth as well. Firms with limited liability have significantly higher growth rates in comparison with other companies. This result is in line with other empirical work, such as Harhoff et al., (1998) and Engel (2002).

Patenting activities have a clear, positive impact on employment growth. Firms that apply for patents have above-average growth rates in the subsequent two years. This conclusion can be drawn from the results of the first-differencing models. The model without selection correction indicates a slightly significant positive effect even in the year of application. According to the fixed-effects estimates, a significant impact is only manifest in the second year after application. Both types of model agree that the effect is greatest in that year. This can be explained by the fact that inventions have to be converted into marketable products or implemented into the production process before they can have an impact on employment. More immediate effects might be due to the hiring of personnel in order to facilitate the execution of these tasks. Firms might also be inclined to recruit new employees promptly in order to be able to fully exploit the competitive advantage implied by their patents.

An obvious weakness of the present model specification is its lack of any financial indicators serving as explanatory variables. Patenting activity might just be an indication of available internal financing, an important factor for growth. Unfortunately, there are no time-varying financial variables available for the present data set, only information on whether investment activities are being carried out by external firms. Such investments should provide an indication of firms' financial situations. However, the corresponding variable proves to be insignificant in the estimations.

They only contain the leading selection indicators which allow testing for selectivity. As the results show, firms leaving the panel consistently show a relatively low employment growth rate in the precedent period. As expected and as ascertained by Almus (2002), attrition due to firm closure is preceded by poor growth performance. That this also holds for drop-outs due to other reasons could be ascribed to firms' reluctance to report on the "rough patches" they go through.

Columns 2 - 4 in table 7.5 refer to estimations without selection correction. These findings indicate the presence of an attrition bias. The last column gives the estimation results of a first-differencing model which corrects for this bias. It is not corrected for a possible bias due to temporary drop-out since the existence of such a bias is rejected by the test. The regression includes the inverse Mills ratios from the T – 1 probit estimations of equation 5 (not reported) as instruments in the first stage and as explanatory variables in the second stage.[11] The significance of the coefficients of six of the seven inverse Mills ratios again confirms the presence of attrition bias. Consequently, one would tend to have more confidence in the results of the regression correcting for the bias. However, the estimated coefficients of the two first-difference regressions differ only slightly. This indicates that the leading selection indicators already correct the bulk of the attrition bias.

Table 7.6 shows the estimation results of the fixed-effects model with autocorrelated disturbances and of the first-differencing model without selection correction using two other patenting measures, namely number of patent applications and patent stock. Comparing the results of the second and fourth columns with the corresponding estimations in table 7.5, it turns out that number of patent applications has less influence on growth than the indicator of whether a firm has applied for any patents. Thus, it is rather the act of carrying out patenting activities itself than a firm's number of patent applications which enhances employment growth. Number of applications might be less meaningful due to the varying quality and economic significance of patents.

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11 Explanatory variables which are included in the probit but not in the 2SLS regression in order to avoid multicollinearity are founders' human capital, region (Eastern or Western Germany), population density, an indicator of whether each firm had received start-up assistance, and indicators of the payment history of each firm. They all lend significant explanatory power to the selection regressions.

Table 7.5: Fixed-effects and first-difference employment growth regressions I

	FE	FE with AR(1)	FD	FD with selection correction
Δ employment t-1	0.041***	-0.045***	-0.001	-0.031
	(0.011)	(0.015)	(0.025)	(0.020)
employment t-1	-0.414***	-0.672***	-1.971***	-1.996***
	(0.022)	(0.038)	(0.566)	(0.517)
$(employment)^2$ t-1	-0.001	-0.0002	0.168**	0.170**
	(0.005)	(0.007)	(0.083)	(0.075)
age t-1	0.060***	0.560**	0.272**	0.302**
	(0.017)	(0.239)	(0.127)	(0.127)
$(age)^2$ t-1	-0.024***	-0.166**	-0.114	-0.124
	(0.008)	(0.072)	(0.166)	(0.173)
empl*age t-1	-0.012***	-0.020*	0.104	0.111
	(0.004)	(0.012)	(0.088)	(0.081)
ltd_liability	0.156***	0.262***	0.390***	0.397***
	(0.038)	(0.057)	(0.063)	(0.064)
patent t	0.052	0.056	0.097*	0.091
	(0.046)	(0.050)	(0.059)	(0.059)
patent t-1	0.039	0.051	0.131**	0.125*
	(0.046)	(0.051)	(0.066)	(0.065)
patent t-2	0.108**	0.107**	0.153***	0.138**
	(0.052)	(0.054)	(0.058)	(0.058)
attrition_dead	-0.112***	-0.113***	-0.134***	-
	(0.019)	(0.021)	(0.024)	
attrition_perm	-0.386***	-0.484***	-0.616***	-
	(0.120)	(0.158)	(0.204)	
attrition_temp	-0.081	0.017	0.125	-
	(0.119)	(0.165)	(0.204)	
mills 93	-	-	-	-0.108
				(0.213)
mills 94	-	-	-	-0.400**
				(0.159)
mills 95	-	-	-	-0.371***
				(0.118)
mills 96	-	-	-	-0.436***
				(0.142)
mills 97	-	-	-	-0.444***
				(0.138)
mills 98	-	-	-	-0.305**
				(0.132)
mills 99	-	-	-	-0.289*
				(0.167)
constant	0.725***	0.751***	-0.029	-0.037
	(0.031)	(0.137)	(0.087)	(0.092)
No. of observations	6820	5549	4098	4098
No. of firms	1271	1175	1029	1029
R^2 within	0.283	0.381	0.226	0.219

*** (**,*) indicates a significance level of 1% (5%, 10%); standard errors in parentheses.

Table 7.6: Fixed-effects and first-difference employment growth regressions II

	FE with AR(1)	FE with AR(1)	FD	FD
Δ employment	-0.045***	-0.045***	-0.0005	-0.0009
	(0.015)	(0.015)	(0.025)	(0.025)
employment t-1	-0.674***	-0.673***	-1.970***	-1.953***
	(0.038)	(0.038)	(0.565)	(0.561)
$(employment)^2$ t-1	-0.0001	-0.0002	0.168**	0.166**
	(0.007)	(0.007)	(0.083)	(0.082)
age t-1	0.566**	0.580**	0.274**	0.279**
	(0.239)	(0.239)	(0.127)	(0.126)
$(age)^2$ t-1	-0.168**	-0.166**	-0.113	-0.118
	(0.072)	(0.072)	(0.165)	(0.165)
empl*age t-1	-0.020*	-0.019*	0.104	0.101
	(0.012)	(0.012)	(0.088)	(0.087)
ltd_liability	0.262***	0.263***	0.390***	0.391***
	(0.057)	(0.057)	(0.063)	(0.063)
numb_pat t	0.059*	-	0.054	-
	(0.032)		(0.034)	
numb_pat t-1	0.022	-	0.053	-
	(0.029)		(0.034)	
numb_pat t-2	0.036	-	0.060**	-
	(0.023)		(0.027)	
pat_stock	-	0.089	-	0.164**
		(0.061)		(0.073)
pat_stock*age	-	-0.030	-	-0.070*
		(0.035)		(0.042)
attrition_dead	-0.113***	-0.113***	-0.134***	-0.135***
	(0.021)	(0.021)	(0.024)	(0.024)
attrition_perm	-0.484***	-0.486***	-0.617***	-0.617***
	(0.158)	(0.158)	(0.204)	(0.203)
attrition_temp	0.017	0.016	0.125	0.124
	(0.165)	(0.165)	(0.204)	(0.204)
constant	0.747***	0.731***	-0.030	-0.026
	(0.136)	(0.136)	(0.087)	(0.087)
No. of observations	5549	5549	4098	4098
No. of firms	1175	1175	1029	1029
R^2 within	0.381	0.381	0.225	0.228

*** (**,*) indicates a significance level of 1% (5%, 10%); standard errors in parentheses.

Unfortunately, using patent grants and citations as a quality indicator is prevented by the nature of the underlying data set: The panel is too short to observe a sufficiently large portion of the time period over which the patents can be granted and cited. According to the fixed-effects model, the effect of number of patent applications is largest in the application year, whereas the first-differencing model still indicates that the greatest effect of patenting activity on employment growth is observed two years later. Patenting stock turns out to be insignificant in the fixed-effects model, perhaps because the underlying assumption of a constantly decreasing impact of patent applica-

tions over time is not entirely correct. However, patenting stock has a significant positive effect on growth according to the first-differencing model, yielding further evidence of patenting activity's positive impact on employment growth. As the interaction term between patent stock and firm age indicates, this effect becomes weaker as firms get older. The effect is only slightly significant, but still suggests that patenting activity affects employment growth more strongly the younger the firm. Innovative activity is probably a more important growth factor for very young firms which have yet to develop a company profile and conquer market shares than for more established firms.

7. Conclusion

This paper analyzes the post-entry growth performance of German start-up firms using descriptive methods, fixed-effects and first-differencing dynamic panel data methods. The advantage of these panel data approaches is that they control for time-constant, unobserved heterogeneity. The estimation results obtained can therefore be accepted as unbiased by firm-specific factors like flexibility, entrepreneurial skills, and organizational and technical abilities, which presumably do not vary much over time and exert considerable influence on firm growth. The econometric methods chosen also account for observed constant heterogeneity resulting, for example, from specific industries, regions, or from cohort effects. They further allow correction of attrition bias.

As revealed by the distribution of start-ups across sectors, the transition process of the former East Germany into a more service-oriented, modern economy has taken place rather slowly. The descriptive results further show that, on average, Eastern German start-ups have been larger, have grown faster, had more seed capital at their disposal and have received more financial assistance than Western German firm foundations in the years after reunification. This is to be attributed to the first-mover advantages which can be realized by new firms in a transition economy and to the focus of German subsidization policies on Eastern Germany. Likewise, innovative firms exhibiting patenting activity are larger, endowed with more seed capital and considered to be more eligible for financial assistance than non-patenting firms. However, they do not evince a better average growth performance. The share of patenting start-ups in all start-ups is somewhat lower in Eastern Germany than in Western Germany. Still, Saxony and Thuringia evince larger shares of patenting firms than many Western states.

The multivariate analysis leads to a clear rejection of Gibrat's Law: Employment growth in the surveyed start-ups is negatively related to firm size in the previous year. This result is consistent with the empirical literature on post-entry performance. Firm age has a positive effect on growth at this early stage of the life cycle; this is likely to turn negative as time passes. The latter

finding is less common in the literature but has already been revealed by some other studies analyzing very young firms.

The other important finding is that involvement in patenting activities enhances a firm's employment growth performance. This is the overall picture arising from the use of different estimation methods and patent indicators. The positive effect of patenting activity may already be present in the year of patent application, but it most likely peaks two years after application. It seems that with respect to growth, the very act of performing patenting activities is more important than the number of patent applications.

The primary objective of this paper is to contribute to the scarce empirical evidence on the impact of innovative activity on post-entry employment growth. Since patents are mostly used to protect product innovations, the results seem to correspond to the empirical literature which mostly reveals a positive impact of these innovations on employment in established firms. However, the findings cannot be generalized because patents are only a partial indicator of innovativeness. Moreover, since no other innovation indicators are used in the analysis, the result may not only reflect the effect of patents per se, but also innovative activities in general; this could also include the ability to appropriate technical knowledge, which is presumably enhanced by patenting activities. It is clear, however, that the results do not just reflect time-constant, unobserved factors like certain technical abilities or open-mindedness to change, which innovative firms are assumed to have – these are already captured by the fixed effects. Patenting firms do not generally exhibit higher growth rates than their non-patenting counterparts; instead, growth performance depends on their patenting activity over time. There is some evidence that patenting activity is a more important growth factor for very young firms than for more established firms. The results suggest that it is beneficial for young firms to innovate at early stages of their life-cycles in order to become competitive and grow.

References

Almus, M., 2002, *Wachstumsdeterminanten junger Unternehmen. Empirische Analysen für Ost- und Westdeutschland*, ZEW Wirtschaftsanalysen, Baden-Baden: Nomos.

Almus M., Engel D., Nerlinger E., 1999, *Wachstumsdeterminanten junger Unternehmen in den alten und neuen Bundesländern: Ein Vergleich zwischen innovativen und nicht-innovativen Unternehmen*, ZEW Discussion Paper, 99-09.

Almus M., Engel D., Prantl S. 2000, *The „Mannheim Foundation Panels" of the Centre for European Economic Research (ZEW)*, ZEW-Dokumentation, 00-02.

Almus M., Nerlinger E., 1999, Wachstumsdeterminanten junger innovativer Unternehmen: Empirische Ergebnisse für West-Deutschland, *Jahrbücher für Nationalökonomie und Statistik*, 218 (3-4), 257-75.

Almus M., Nerlinger, E., 2000, A Testing "Gibrat's Law" for Young Firms – Empirical Results for West Germany, *Small Business Economics*, 15(1), 1-12.

Almus A, Prantl S., Brüderl J., Stahl K. 2001, *Woywode M. Die ZEW-Gründerstudie – Konzeption und Erhebung*, ZEW-Dokumentation, 01-01.

Audretsch D. B. 1995, Innovation, Growth and Survival, *International Journal of Industrial Organization*, 13(4), 441-57.

Audretsch D.B., Klomp L., Thurik A.R., 1999, "Do Services Differ from Manufacturing? The Post-Entry Performance of Firms in Dutch Services." In *Innovation, Industry Evolution, and Employment*, Audretsch D.B., Thurik A.R., ed. Cambridge University Press, 230-52.

Audretsch D.B., Mahmood T., 1994, Firm Selection and Industry Evolution: The Post-Entry Performance of New Firms, *Journal of Evolutionary Economics*, 4, 243-260.

Becchetti L., Trovato G., 2002, The Determinants of Growth for Small and Medium Sized Firms. The Availability of External Finance, *Small Business Economics*, 19, 291-306.

Blechinger D., Pfeiffer F., 1999, Qualifikation, Beschäftigung und technischer Fortschritt. Empirische Evidenz mit den Daten des Mannheimer Innovationspanels, *Jahrbücher für Nationalökonomie und Statistik*, 218 (1+2), 128-46.

Blechinger D., Kleinknecht A., Licht G., Pfeiffer F., 1998, *The Impact of Innovation on Employment in Europe – An Analysis using CIS Data*, ZEW-Dokumentation, 98-02.

Bloom N., Van Reenen J., 2002, Patents, Real Options and Firm Performance, *Economic Journal*, 112(478), C97-C116.

Brouwer E., Kleinknecht A., Reijnen J.O.N., 1993, Employment Growth and Innovation at the Firm Level, *Journal of Evolutionary Economics*, 3, 153-59.

Cohen W.M., Klepper S., 1996, A Reprise of Size and R&D, *Economic Journal*, 106, 925-51.

Cohen W.M., Goto A., Nagata A., Nelson R.R., Walsh, J.P., 2002, R&D Spillovers, Patents and the Incentives to Innovate in Japan and the United States, *Research Policy*, 31(8-9), 1349-67.

Czarnitzki D., Kraft C., 2004, *On the Profitability of Innovative Assets*. ZEW Discussion Paper, 04-38.

Das, S., 1995, Size, Age and Firm Growth in an Infant Industry: the Computer Hardware Industry in India, *International Journal of Industrial Organization*, 13, 111-26.

Doms M., Dunne T., Roberts M.J., 1995, The Role of Technology Use in the Survival and Growth of Manufacturing Plants, *International Journal of Industrial Organization*, 13(4), 523-42.

Engel, D., 2002, *The Impact of Venture Capital on Firm Growth: An Empirical Investigation*, ZEW Discussion Paper, 02-02.

Evangelista R., Savona M., 2003, Innovation, Employment and Skills in Services: Firm and Sectoral Evidence. *Structural Change and Economic Dynamics*, Special Issue 14(4), 449-74.

Evans D.S., 1987a, The Relationship between Firm Growth, Size, and Age: Estimates for 100 Manufacturing Industries, *Journal of Industrial Economics*, 35, 567-81.

Evans D.S., 1987b, Tests of Alternatives Theories of Firms Growth, *Journal of Political Economy*, 95(4), 657-74.

Fritsch, Michael, 1990, *Arbeitsplatzentwicklung in Industriebetrieben*. Berlin: de Gruyter.

Geroski P. A., 1995, What Do We Know About Entry?, *International Journal of Industrial Organization*, 13, 421-40.

Geroski P., 1999, *The Growth of Firms in Theory and in Practice*, CEPR Discussion Paper, 2092.

Geroski P., Machin S., Van Reenen J., 1993, The Profitability of Innovating Firms, *Rand Journal of Economics*, 24; 198-211.

Gibrat, Robert, 1931, *Les inégalités économiques; applications: aux inégalités des richesses, à la concentration des entreprises, aux populations des villes, aux statistiques des familles, etc., d'une loi nouvelle, la loi de l'effet proportionnel.* Paris: Librairie du Recueil Sirey.

Goddard J., Wilson J., Blandon P., 2002, Panel Tests for Gibrat's Law for Japanese Manufacturing, *International Journal of Industrial Organization*, 20, 415-33.

Greenhalgh C., Longland M., Bosworth D., 2001, Technological Activity and Employment in a Panel of UK Firms, *Scottish Journal of Political Economy*, 48(3), 260-82.

Greif, S., Schmiedl, D., 2002, *Patentatlas Detuschland – Ausgabe 2002 –. Dynamik und Strukturen der Erfindungstätigkeit.* München: Deutsches Patent- und Markenamt.

Griliches Z., 1990, Patent Statistics as Economic Indicators: a Survey, *Journal of Economic Literature*, 18(4), 1661-707.

Griliches, Z., Mairesse, J., 1984, "Productivity and R&D at the Firm Level." In *R&D, Patents and Productivity*, Griliches, Z., ed. Chicago.

Harhoff D., Stahl K., Woywode M., 1998, Legal Form, Growth and Exit of West German Firms – Empirical Results for Manufacturing, Construction, Trade and Service Industries. *Journal of Industrial Economics*, 46(4), 453-88.

Heckman J.J., 1979, Sample Selection Bias as a Specification Error, *Econometrica*, 47, 153-61.

Honjo Y., 2004, Growth of New Start-up Firms: Evidence from the Japanese Manufacturing Industry, *Applied Economics Letters*, 11, 21-32.

Hsueh L., Tu Y., 2004, Innovation and the Operational Performance of Newly Established Small and Medium Enterprises in Taiwan, *Small Business Economics*, 23(2), 99-113

Jaumandreu J., 2003, Does Innovation Spur Employment? A Firm-Level Analysis Using Spanish CIS Data. mimeo.

Jovanovic, B., 1982, Selection and the Evolution of Industry. *Econometrica*, 50(3), 649-70.

Katsoulacos, Y. S., 1986, *The Employment Effect of Technical Change.* Brighton: Wheatsheaf.

Kirchhoff, B.A. and Phillips, B.D., 1989, "Innovation and Growth Among New Firms in the US Economy." In *Frontiers of Entrepreneurship Research*, Wellesley, MA: Babson College, 173-188.

Kline, S.J., Rosenberg, N., 1986, "An Overview of Innovation." In *The Positive Sum Strategy: Harnessing Technology for Economic Growth*, Landau, R., Rosenberg, N., ed. Washington DC: National Academy Press.

Klomp L., Van Leeuwen G., 2001, Linking Innovation and Firm Performance: A New Approach, *International Journal of the Economics of Business*, 8(3), 343-64.

König H., Licht G., 1995, Patents, R&D and Innovation: Evidence from the Mannheim Innovation Panel, *Ifo Studien*, 41(4), 21-43.

Leo H., Steiner V., 1995, Technological Innovation and Employment at the Firm Level. Vienna: WIFO, Austrian Institute of Economic Research.

Licht G., Zoz K., 1996, *Patents and R&D. An Econometric Investigation Using Applications for German, European and US Patents by German Companies*, ZEW Discussion Paper, 96-19.

Lotti F., Santarelli E., Vivarelli M., 2001, The Relationship Between Size and Growth: The Case of Italian Newborn Firms, *Applied Economics Letters*, 8(7), 451-454.

Lotti F., Santarelli E., Vivarelli M., 2003, Does Gibrat's Law Hold Among Young, Small Firms?, *Journal of Evolutionary Economics*, 13, 213-235.

Lööf H., Heshmati A., 2004, Finance, R&D, and Productivity: Correlation or Causality? Preliminary Version presented at the 10th Meeting of the International Schumpeter Society, 9-12 June 2004; Milan.

Mansfield E., 1962, Entry, Gibrat's Law, and the Growth of Firms, *American Economic Review*, 52(5), 1023-51.

Markusen, A., Hall, P., Glasmeier, A., 1986, *High Tech America, The What, How, Where, and Why of the Sunrise Industries*. Boston: Allen & Unwin.

Mata J., 1994, Firm Growth during Infancy, *Small Business Economics*, 6(1), 27-39.

Penrose, E., 1959, *The Theory of the Growth of the Firm*. Oxford: Basil Blackwell.

Peters B., 2004, *Employment Effects of Different Innovation Activities: Microeconometric Evidence*. ZEW Discussion Paper, 04-73.

Prantl, Susanne, 2002, *Bankruptcy, Subsidized Loans, and Exit Decisions of Start-up Firms*. Online-Ressource, Mannheim, Univ., Diss.

Rottmann H., Ruschinski M., 1997, Beschäftigungswirkungen des technischen Fortschritts. Eine Paneldaten-Analyse für Unternehmen des Verarbeitenden Gewerbes in Deutschland, *Ifo Studien*, 43, 55-70.

Smolny, Werner, 1998a, *Endogenous Innovations and Knowledge Spillovers – A Theoretical and Empirical Analysis*. ZEW Economic Studies 12, Heidelberg: Physica-Verlag.

Smolny W., 1998b, Innovation, Prices, and Employment – A Theoretical Model and an Empirical Application for West German Manufacturing Firms, *Journal of Industrial Economics*, 46, 359-81.

Tether B.S., 1997, Growth Diversity Amongst Innovative and Technology-based New and Small Firms: An Interpretation. New Technology, *Work and Employment*, 12(2), 91-107.

Van Reenen J., 1997, Employment and Technological Innovation: Evidence from U.K. Manufacturing Firms. *Journal of Labour Economics*, 15(2), 255-84

Wooldridge, J.M., 2002, *Econometric Analysis of Cross Section and Panel Data*. Cambridge, Massachusetts: MIT Press.

8 ENTREPRENEURSHIP IN CLUSTER

The Surgical Instrument Cluster of Tuttlingen, Germany*

Ralf Binder and Björn Sautter

1. Introduction

In recent years there has been intensive scientific discussion about the concept of clusters[1], in which attention has also been given to business foundings (cf. Sternberg and Litzenberger, 2004; Fornahl and Menzel, 2002). Theoretical arguments propose that the particular economic and social environmental framework conditions of a cluster have an effect on entrepreneurial activities in the cluster (cf. Feldman, 2001; Saxenian, 1994; Krugman, 1991). However, interpretations of the direction of the effect differ substantially.

Several authors argue that high founding rates observed in clusters indicate the presence of Marshallian localization economies which facilitate access to resources and information relevant to founders and reduce entry barriers (cf. Sorenson and Audia, 2000; Baum and Haveman, 1997). Additionally, the social environment of clusters offers some special features (Fornahl, 2003; Inkpen and Tsang, 2005) that could also influence entrepreneurial activities. For example, in clusters, economic ties often overlap with personal ties (Dei Ottati, 1994), resulting in dense and long-enduring networks (Rowley et al. 2000) and sometimes in cliques with a high level of redundant ties (Storper, 1993).

On the other hand, studies drawing on the organizational ecology approach stress the strong competition for resources in regional agglomerations of industries, and, thus, focus on the negative effects on entrepreneurial activity (Hannan and Freeman, 1989; Hannan and Carroll, 1992; Carroll and Hannan, 2000). In order to make an assessment of these opposing arguments, more empirical knowledge is necessary. These studies provide us with some fasci-

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1 The concept has been used and interpreted in very different ways (cf. the critique in Martin and Sunley, 2003).

nating theoretical assumptions, but they suffer from a lack of empirical data about the socio-economic mechanisms and processes related to business foundings.

In this paper, we aim to fill this empirical gap by presenting the results of a study which intend to examine the socio-economic mechanisms and processes related to the entrepreneurial activities in a cluster. Using the surgical instrument cluster of Tuttlingen as an example, we investigate the environmental conditions relevant to business foundings in the cluster and the temporal variations in the relationship between these founding conditions and the founding activity. As one of the most important conditions for the entrepreneurial activities in the cluster, we identify the social capital of founders. We examine elements of the social capital and its significance for the success of business start-ups, and identify mechanisms by which founding success is influenced by social capital. In our investigations, we use a mix of quantitative and qualitative methods.

The remainder consists of five sections. In section 2 we give some background information on the surgical instrument cluster of Tuttlingen. Section 3 contains a review of the socio-economic founding conditions in a cluster. A description of the methodology is given in section 4, and in section 5 the empirical results are presented. Finally, we summarize the findings and draw some conclusions (section 6).

2. The Case Study

Generally speaking, the notion of a 'cluster' refers to a spatially concentrated group of companies, which are specialized in some related industrial activities (Lorenzen, 2001). The cluster studied in our investigation is situated in a rural part of southern Baden-Württemberg, Germany, around the city of Tuttlingen (see figure 8.1). Concerning the surgical instrument industry, Tuttlingen is a unique phenomenon, at least in Germany.[2] The cluster is distinguished by a high concentration of some 500 mainly small or medium-sized companies producing and trading primarily surgical instruments, and to a lesser extent endoscopes and implants. Approximately 200 specialized suppliers and subcontractors complete the cluster. The concentration is limited to the county of Tuttlingen, whereas surrounding counties have virtually no companies of the surgical instruments industry. Altogether, the companies in the district of Tuttlingen represent two-thirds of all German companies engaged in this line of business; others are dispersed all over Germany. Some more figures shall indicate the significance of the cluster. In the year 2002 the cluster employed a total of 7,500 people and produced an estimated turnover of US$ 610 million. The main markets of the firms in the cluster are Germany, the USA, Europe and Japan, and the export share of firms with at least 20 employees is 64 per-

2 There is a competing cluster in Sialkot in Pakistan (Nadvi and Halder, 2002).

cent (Halder, 2004). The significance of the surgical instruments industry for the regional economy is high, with almost 15 percent of all employees subject to social insurance contributions in the county working in this line in 2002 (Sources: Job Centre Rottweil, Statistical State Office Baden-Württemberg).

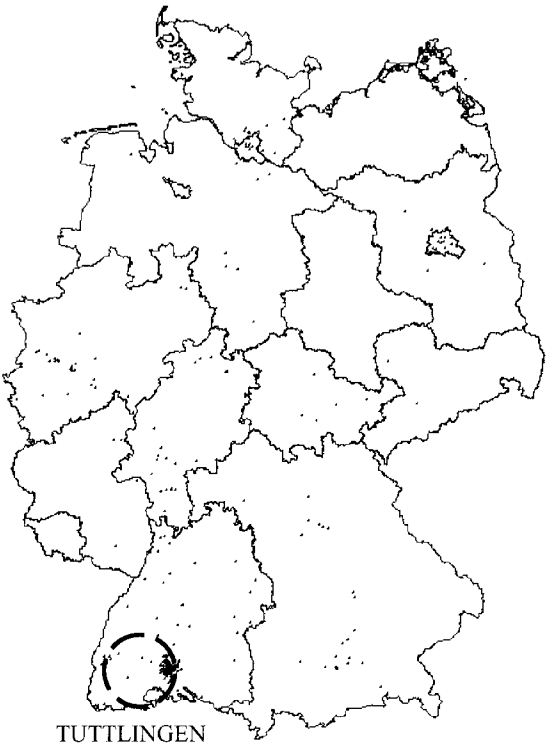

Figure 8.1: Locations of companies in the surgical instrument industry in Germany

There are a number of reasons that make this cluster an appropriate case study. First, because of its rural character, there are almost no urbanization economies that interfere with the localization economies of the cluster. Second, the origins of the cluster date back over 130 years, so changes in entrepreneurial framework conditions can be well examined. Finally, the number of firms founded is large enough to allow adequate statistical analysis.

3. Socio-Economic Founding Conditions in Clusters

According to Staber (1997), founding conditions in clusters are driven by cooperative and competitive socio-economic processes. These dynamic processes reflect inter-firm learning, operational flexibility, and innovation, and

are seen as the source of a cluster-specific economic vitality. In the following sections, we focus first on temporal variations in the relationship between general founding conditions like cooperation, competition, etc. and the entrepreneurial activity in the evolution of the cluster. Second, we investigate the social capital of business founders as one of the founding conditions in the cluster.

3.1 Founding Conditions and Entrepreneurial Activity in the Evolution of Clusters

Many studies assume a higher level of founding activity in clustered areas than in non-clustered areas (cf. Sternberg and Litzenberger, 2004; Fornahl and Menzel, 2002). Authors of the 'new economic geography' suggest that due to competitive advantages in a cluster, there are low entry barriers, and this, therefore, has positive effects on entrepreneurial activity (cf. Krugman, 1991). Nascent entrepreneurs, thus, benefit from elements of the localization economies such as skilled labor, supportive infrastructure and specialized suppliers on site (Marshall, 1890), and from knowledge spillovers (Saxenian, 1994). Studies that focus on the social environment of entrepreneurs point out the embeddedness of entrepreneurs in networks of continuing social relations (cf. Aldrich and Zimmer, 1986; Bosma et al., 2002). Mutual trust and common norms, rules, and routines for acting are a fundamental element of social relations and, thus, are a basic requirement for a well-functioning network. The pronounced 'institutional endowment' in clusters leads to 'localized capabilities' (Maskell and Malmberg, 1999) or 'untraded interdependencies' (Storper, 1997). Over time, an 'institutional thickness' evolves (Amin and Thrift, 1995) that includes formal institutions such as further education and training establishments, and trade and similar organizations that may encourage systemic trust among the actors in the cluster (cf. Bachmann, 2003).

However, as Porter (1998, 2000) notices, fierce competition among local companies is another typical attribute of clusters. The firms compete for critical resources such as know-how, skilled labor, specialized suppliers, capital, customers, etc. (Hannan and Freeman, 1989; Hannan and Carroll, 1992; Carroll and Hannan, 2000). As a result, established companies may try to hinder start-ups, and they may be closed down soon after founding, due to resource squeeze.

In conclusion, clusters are characterized by a conflicting interrelation of socio-institutional embeddedness and cooperation, on the one hand, and competition for critical resources, on the other. Stability and equilibrium in this interrelation are rare; instead, temporal disequilibria are the norm. Most empirical studies dealing with this subject use a static design. As a result, they do not capture the dynamics of how the balance of cooperation and competition evolves over time, with implications for understanding changes in entrepreneurial activity. The organizational ecology approach enables investigations

of dynamic processes like time-varying cooperation, competition, and entrepreneurial activity in the evolution of a cluster. Staber (1997) used the ecological concept of population density – i.e., the number of firms existing at a given point in time, relative to available resources in their environment – to study temporal variations in the founding activity as a function of changes in the intensity of cooperation and competition.

Organizational ecologists assume that during the early history of cluster development, when population density is low, an increase in density leads to greater legitimation, i.e., acceptance by authorities, lenders, suppliers, clients, etc. (Meyer and Rowan, 1977), and to a higher potential to cooperate (Staber, 1997), facilitating founding activity. However, an increasing density also leads to greater competition for available resources. According to the organizational ecology approach, as density increases, legitimation and the potential to cooperate increases at a slower rate and competition increases at an increasing rate. Thus, when population density exceeds a certain limit, the negative effect of increased competition for resources outbalances gains made in respect of legitimation and potential to cooperate. From this point on, founding activities decrease. From early to late stages of cluster development, these processes lead to an inverse U-shaped relationship between population density and the founding activity, assuming that the carrying capacity of the population's environment is fixed over time. Many empirical studies confirm this non-monotonic relationship between density and founding activity.[3]

An ecological analysis of entrepreneurial activity in a cluster has to consider contextual factors besides population density. These additional founding conditions are general framework conditions (such as the general business climate), industry-specific framework conditions (such as the national and international demand for products), as well as further cluster-specific conditions (such as strategies of local firms or changes in the local value chain). Additional parameters concerning the founding capability within the cluster, e.g. the number of potential founders, could complete an analysis of business foundings in a cluster.

3.2 Social Capital as an Important Founding Condition in Clusters

As discussed above, several environmental framework conditions affect the entrepreneurial activity in clusters. The social environment distinguishes clusters from other economic areas (Dei Ottati, 1994; Rosenfeld, 1997; Gordon and McCann, 2000). Hitherto, there have only been a few studies that try to combine the special features of the social environment and start-ups in clusters (Britton 2004, Westlund and Bolton 2003).

3 For reviews see Carroll (1984), Singh and Lumsden (1990), Hannan and Carroll (1992).

Studies by Halder (2004) and Nadvi and Halder (2002) illustrate the importance of the social environment for economic activities in the cluster of Tuttlingen. To include the social environment in our considerations, we can draw on several theoretical concepts, such as the social networks concept, the embeddedness model, and the social capital model.[4] The social capital model has recently been attracting much attention, and there are some studies that examine the importance of social capital for entrepreneurs (Bühler, 1999; Bosma et al., 2002; Maurer, 2003). However, the notion of social capital is used in different ways.[5] In the following paragraphs, we refer to an entrepreneur's social capital as being, first, the configuration of the whole network of his social contacts and, second, the characteristics and content of his individual ties. While the characteristics of the contacts – for example, their human capital – are not included in an entrepreneur's social capital, they do have a significant influence on the individual ties and, therefore, should also be taken into account. Thus, we adopt a structure-oriented perspective of social capital (Maurer, 2003).

Following Nahapiet and Ghoshal (1998), we distinguish three dimensions of social capital. The structural dimension contains the overall configuration of the network and includes the size of the network, its heterogeneity and its multiplexity. Extensive and heterogeneous networks are beneficial particularly for founders as they provide access to the diverse resources that are necessary for founding a firm, and can enable the entrepreneurs to overcome a lack of own resources (Steier and Greenwood, 2000, 166). Multiple ties provide founders with access to more and different resources (Maurer, 2003, 33). The relational dimension is relevant to trust and norms, each of which can serve as a control mechanism in a particular tie. Both reduce the danger of opportunistic behavior and can contribute to a reduction of transaction costs (Nooteboom, 1999).[6] The cognitive dimension includes the way actors interpret situations. The interpretation in the context of entrepreneurship relevant situations might be who are the most important competitors or which are considerable technical innovations. considerable. If there is cognitive proximity between the actors, that is, if they have common or similar interpretation schemes, the effective exchange of experience, advice and information, the interpretation of what they have, and new combinations of information are all made easier (Tsai and Ghoshal, 1998; Boschma, 2005).

The function of social capital is to enable the owner to acquire resources to attain certain goals, or to make those goals easier to reach (Coleman, 1990). The value of social capital depends on the context and, in connection with

4 For a full discussion of the network model, see the bibliography; for an extensive account of the embeddedness model, see Granovetter (1985), and Uzzi (1996). The basic idea of the embeddedness model is that economic actors are embedded in a social framework that influences their actions. This idea is also the basis of the social capital model.

5 A good summary can be found in Adler and Kwon (2002).

6 Fundamental for the transactions cost model, see Williamson (1975).

founding firms, advice about how to found them, being able to draw on capital and tangible assets, unpaid assistance and emotional support, can all be especially valuable. The possibilities and limitations with regard to access to these resources result from the position of a founder in the network and the configuration of the particular ties. The social capital of entrepreneurs who set up firms eases the acquisition of resources and, thus, influences the success of the new firm (Bühler, 1999).

As a result of these considerations, we propose several hypotheses:[7]

- The multiplexity of social roles in a dyadic relation (e.g. two persons interconnected via a business and a friendship relation) leads to an increase of accessible resources and the variety of these resources embedded in this relation (Grabher and Stark, 1997). Founders whose social capital includes a large proportion of multiplexities are more successful.
- Trust accounts for easier access to resources (Liebeskind, Oliver, Zucker and Brewer 1996; Larson, 1992). Founders with social capital characterized by trust are, therefore, more successful.
- Cognitive proximity facilitates the exchange of information and is conducive to innovation (Talmud, 1999; Boschma, 2005). Founders with ties characterized by cognitive proximity are more successful.

The hypotheses concerning the role of social capital have to be interpreted in the light of the special start-up conditions in a cluster. In a cluster, specific social capital can be built up through a combination of special local features, such as intense competition and local institutions. For clusters, Gordon and McCann (2000) see an exceptionally high level of actors' social embeddedness combined with a number of advantages - for example, lowered transaction costs as a result of trust between the actors (Enright, 2003, 105). Of course, social capital can also have a 'dark side' if it results in cognitive lock-ins (Portes, 1998; Putnam, 2000). In general, social capital is a fundamental component for developing 'collective entrepreneurship' in a region and, thus, may strongly influence the founding activity (Westlund and Bolton, 2003).

4. Methodology

Our research questions for this study were of explorative and of hypothesis-testing nature. Besides the testing of the hypothesis, we intended to identify mechanisms by which founding activities are influenced, and how social capital affects success of start-ups. The conceptual framework developed for the determinants of the founding activities in clusters and the relevance of social capital for entrepreneurs clearly showed that it was favorable to use a multi-level analysis and to work with a combination of quantitative and qualitative

7 In addition, a number of other hypotheses were made relating to further social capital variables and control variables.

methods. The use of ethnographic methods of data collection enabled us to check the validity of the quantitative observations (Uzzi, 1996).

To analyze founding conditions in the selected cluster, we drew on the Business Registration Index of several municipalities as our main data source for both investigations. Using those indices, we compiled a database of the surgical instrument firms that had been set up or closed down in the Tuttlingen district from 1945 to 2002, inclusively. As an adjustment, we used additional data sources (e.g. several surgical instrument manufacturer directories), and in doing so we were able to overcome several limitations of Business Registration Indices as a source of information (cf. Fritsch and Grotz, 2002). Our search produced a total of 856 firms at the core of the surgical instrument industry and 349 firms or home workers specializing in complementary activities (polishing, grinding, drilling, etc.) that had been operating for at least one year between 1945 and 2002. In this period, 621 firms were established and 294 firms were closed down at the core of the surgical instrument industry (cf. figure 8.2). Using additional archival sources, we were able to reconstruct the annual number of foundings[8] of craft firms within the surgical industry sector from 1870 to 1940.

In the empirical analysis of time-varying founding conditions and founding activity, we followed the convention in defining a population of firms as the unit of analysis and treated foundings as events in a point process, i.e. as an instant of an arrival process, for the population (cf. Hannan and Freeman, 1989). Because we used annual numbers of foundings for the period from 1947 to 2000[9], we modeled the aggregated annual event counts directly instead of analyzing event histories. Therefore, we assumed a founding rate (in terms of a stochastic hazard rate) with log-linear dependence on density and the covariates as given by the following equation:

$$\lambda_t = \exp(\alpha_0 + \alpha_1 N_t + \alpha_2 N_t^2 + \sum \alpha_3 X_t)$$

where α0 is the intercept, Nt is density, and Xt is the set of covariates. The density dependence model predicts that $\alpha 1 > 0$ and $\alpha 2 < 0$. The models of the founding activity we chose are based on the simple Poisson model.[10]

We considered the surgical instrument cluster of Tuttlingen, which was introduced in section 2, as a community of organizations in the ecological sense. The organizational population under study was the set of manufactur-

8 Unfortunately, we were not able to reconstruct the deaths.

9 We transformed the yearly number of foundings into a moving average of four years, eliminating extreme mavericks (cf. figure 8.2 and 8.3). We also estimated models with the actually observed numbers of foundings. The results of these models are similar to the results we present in this paper.

10 A complication arises if the assumption of the variance of the Poisson distribution equaling the mean does not hold. To test this assumption, the authors estimated the negative binomial regression model, which allows for over dispersion. The results from this estimation were no improvement over the Poisson model. Hence, Poisson estimates are reported below.

ing and trading firms that defined the cluster as a socio-economic entity. As a result of increasing diversification of strategies and forms of organization employed by firms, we separated the sub-population of manufacturers (MANU) from the sub-population of traders (TRADE), including some service providers. Referring to the population as a whole (ALL), and the two sub-populations, we estimated the ecological model mentioned above. We tested several environmental variables as covariates to account for the changes in the level of the founding activity. Prior business failures, for example, provided potential founders with information about opportunities and constraints. High levels of dissolutions may be interpreted as a signal that opportunities are declining, thus, repressing start-ups, whereas low levels of dissolutions should have the opposite effect. The experts we interviewed stressed the impact of the exchange rate of the US dollar on international demand for surgical instruments. Therefore, we used this exchange rate as a proxy variable for the environment's carrying capacity, in terms of demand for the surgical instruments.[11]

The regression models we calculated served as a basis for discussion in the 23 interviews conducted with local and non-local experts in the surgical instrument industry and also with representatives of recognized institutions in the cluster environment. To cross-reference our findings and to bridge the gap to the past, we analyzed archival sources (e.g. about 1,500 newspaper articles). This supplementary information was used to prepare the semi-structured interviews with established entrepreneurs. We interviewed 32 entrepreneurs who had set up their businesses between the 1950s and the 1990s, and evaluated their particular founding conditions. The selection of entrepreneurs interviewed was based on a stratified random sample.

Concerning social capital, our data base contained 147 people who had become self-employed in the surgical instrument industry in the cluster between 1998 and 2002.[12] In order to check whether a founder was appropriate for our purposes, we made telephone calls to check some of his/her characteristics:

- Entrepreneurs must have set up a firm for the first time, as those who had previously established one could probably call on networks created earlier.
- When taking over a firm, founders should not have been a long-term employee or a relative of the previous owner because in this case, it can be

11 We estimated the models with a number of additional covariates such as GNP growth rates, unemployment rate, number of insolvent firms, rate of self-employed, public expenditure for health care, export quotas of fine mechanics as well as of medical devices, number of newly-examined mechanics in surgical instruments with a master craftsman's diploma, etc. Covariates other than prior deaths and the exchange rate of the US dollar did not improve the model's fit substantially.

12 According to Knoke (1994), three possibilities can be considered for defining the networks to be studied: first, using the characteristics of the network actors; second, using the kind of relationships; and third, using the participants in certain events. In our case, the definition was based on the characteristics of the network actors.

assumed that some of the network contacts of the predecessor would be transferred.

Of the 119 people who were contacted,[13] 64 did not match all of our sampling criteria and, therefore, were not included in the sample. Of the 55 remaining people, 32 were willing to take part in an interview, representing a success rate of 38 percent. To be able to assess alternative explanatory models, we conducted 25 supplementary interviews with entrepreneurs. Those additional interview partners had established their firms in 1997, have been working as suppliers, had inherited the firm as family members or had founded a firm outside the cluster.

The data were collected by means of interviews that were guided and, to some extent, standardized. The structural dimension of social capital was captured by using indicators of heterogeneity, strength, and multiplicity of the network ties.[14] Concerning the relational dimension, we limited the study to the measurement of trust; the cognitive dimension was measured by the cognitive proximity of the other participant in the discussion. Whenever possible, we went back to reliable valid constructs used in prior studies. We determined levels of trust and cognitive proximity using open questions, and subsequently we categorized the answers. Apart from questions related to the social network, we also asked questions about the related benefits of support and about purely economic success variables.[15] In addition, we collected a number of control variables and complementary assessments from the perspective of the founders.

We gathered ego-centered network data by questioning the founders (egos) about their conversational partners (alteri) in the last six months.[16] For reasons of time, the collection of the detailed relational data had to be limited to the five most important conversational partners. The interviewees gave the names of 180 conversational partners, and we gathered detailed data on 116 of the relationships. Limiting the time of recognition to the previous six months was necessary in order to get reliable statements (Marsden, 1990, 456). For the evaluation of the qualitative interview data, we drew on the consideration suggested by Meuser and Nagel (1991).

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13 We were not able to contact 29 people, either by phone or in person.

14 The questions were oriented towards studies that had been carried out previously (cf. Bühler, 1999; Burt et al., 2000).

15 Success measures used: sales growth since the firm was founded, number of employees, and share of sales for the three most important customers (cf. for success measures for new firms, see Brüderl and Preisendörfer, 1996).

16 We limited our survey to symmetric, ego-centered, and first order networks. For the advantages and disadvantages of this method see, for example, Marsden (1990). For the basics of social network analysis, see Wasserman and Faust (1994). Since there are methodical restrictions concerning social network analysis, e.g. biases in retrospection of interviewees, we limited the investigation to founders who have set up a business during 1998 and 2002.

5. Empirical Results Concerning the Surgical Instrument Cluster in Tuttlingen

5.1 Founding Conditions and Entrepreneurial Activity in the Evolution of the Cluster

The number of firms established or dissolved varies considerably during the evolution of the surgical instrument cluster of Tuttlingen. Figure 8.2 shows cyclical variations of the founding activity as well as a secular trend of increasing business start-ups from 1870 to 2002. From 1993 on, there is a significant increase in the number of business failures. The numbers of 'births' and 'deaths' concerning the sub-populations of manufacturing firms and trading firms, including service providers, are shown in figure 8.3. In the sub-population of manufacturing firms, the numbers of births show cyclical variations but no significant trend. In the sub-population of trading firms, including service providers, the numbers of births show a significant increasing trend of business foundings, with a 'take-off' in the early 1970s.

Table 8.1 shows the maximum likelihood estimates of the Poisson model of density dependence, concerning the founding activity in the surgical instrument cluster of Tuttlingen from 1947 (1953, trader and service providers) to 2000. The baseline model ALL (1) estimates the density dependence of the founding activity in the population of manufacturers and traders, including service providers, as a whole. Models ALL (2) and ALL (3) add the covariates of prior deaths and exchange rate of the US dollar. The results of these models concerning the core of the surgical instrument cluster do not support the assumptions of the density dependence model. The coefficients of the linear and quadratic term of population density do not correspond to the predictions of the ecological approachl. The same results shows model MANU estimating the density dependence of the founding activity in the sub-population of manufacturers exclusively.

In model TRADE, concerning the founding activity in the sub-population of traders, including service providers, the first and second order effects of population density are significantly positive and negative as predicted in the ecological model. This result confirms the assumption that at a low level of population density, the addition of new organizations supports the legitimation of existing organizations and raises the potential for cooperation, thus, facilitating foundings. As density grows to a high level, further foundings intensify competition over access to critical resources, and, thus, reduce the level of founding activity.

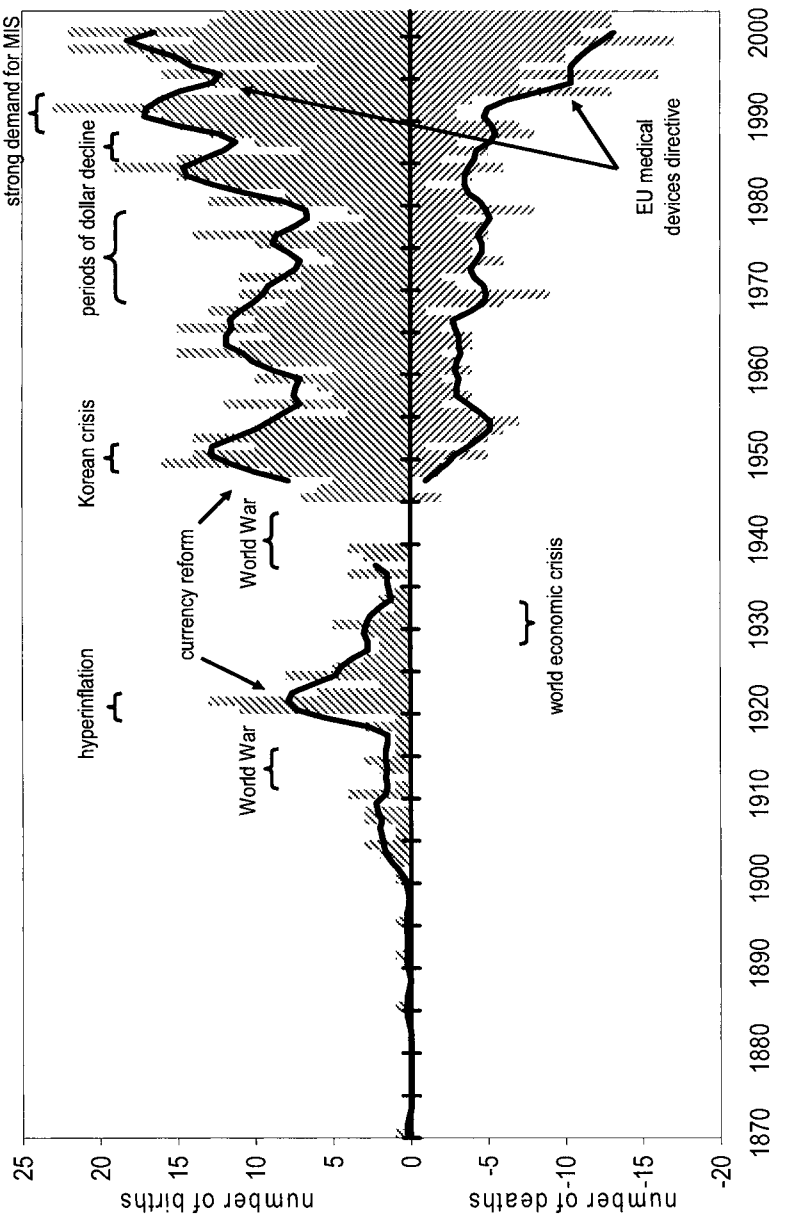

Figure 8.2: Births and deaths in the surgical instrument cluster of Tuttlingen 1870-2002 (moving average of 4 years in continuous line)

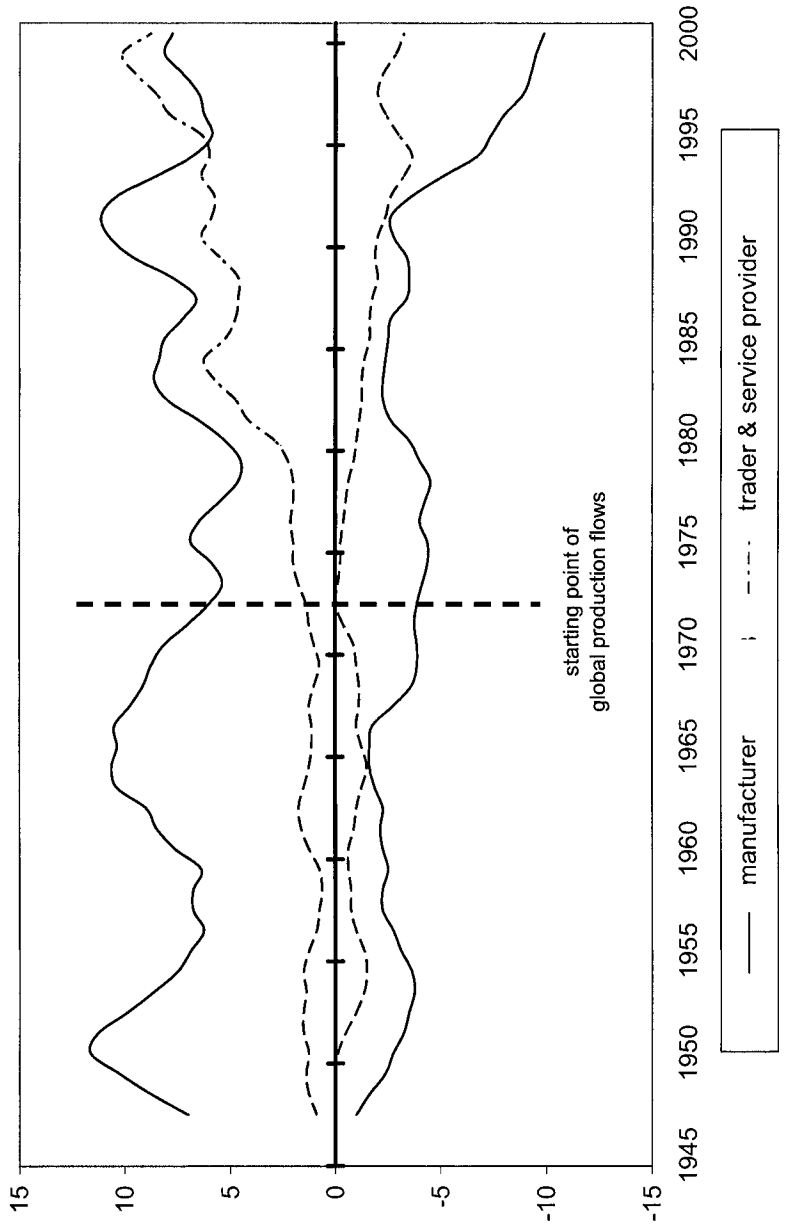

Figure 8.3: Births and deaths of manufacturers and traders in the surgical instrument cluster of Tuttlingen 1947-2000 (moving average of 4 years)

Table 8.1: Poisson regression models of the founding activity (standard errors in parentheses)

	Models				
Variables	ALL (1)	ALL (2)	ALL (3)	MANU	TRADE
Constant	2,990***	3,787***	1,684	1,667	-2,350*
	(0,500)	0,602	(1,396)	(1,529)	(1,094)
Density	-0,006	-0,011**	-0,004	-0,008	0,089***
	(0,003)	(0,004)	(0,007)	(0,010)	(0,021)
Density^2/1000	0,012*	0,020**	0,014	0,024	-0,409**
	(0,005)	(0,006)	(0,009)	(0,018)	(0,119)
Prior Deaths	-	-0,057*	-0,062	-0,067	-0,317*
		(0,027)	(0,032)	(0,034)	(0,159)
Exchange Rate of the US-Dollar	-	-	0,214*	0,293*	0,310
			(0,105)	(0,128)	(0,200)
Log likelihood	-124,54	-120,03	-106,20	-96,95	-86,87
Pseudo R^2	0,094	0,110	0,143	0,049	0,366
Period	1947-2000	1947-2000	1953-2000	1953-2000	1953-2000

Notes: Statistical significance of variables indicated by: * = 5 %, ** = 1 %, *** = 0,1 %.

In all estimated models, the covariates show the same effect. A decline in prior deaths, together with a rise of the US dollar exchange rate, increases the founding activity. Both covariates provide potential founders with information about opportunities and constraints concerning the environment's carrying capacity, in terms of the absolute level of material resources for which firms compete.

We could assume several reasons as to why the models of the population as a whole (ALL) and of the sub-population of manufacturers (MANU) do not confirm the density dependence model. One reason could be that we cannot equate the surgical instruments cluster of Tuttlingen with a population of its own. Maybe the definition of the population has to be the global surgical instrument industry, as Tuttlingen manufacturers have sourced production steps out, as well as building up external subsidiaries, especially in low-wage countries (cf. Nadvi and Halder, 2002; Halder, 2005). However, the interviewed experts confirmed the assumption that the firms in the cluster primarily interact and compete locally for critical resources. Therefore, the cluster level still has to be regarded as the appropriate level of analysis.

Another explanation might be the absence of strong cooperation and competition influencing the founding activity. In our investigation, we observed intense interaction and fierce competition in the cluster, but we could not find fundamental changes in the cooperation and competition associated with population density. Although we identified formal cooperation and 'institutional thickness' in the cluster (table 8.2), the intense competition for critical

resources such as tacit knowledge and access to customers produces a 'culture of systemic mistrust', and prevents joint action and 'collective efficiency' (Schmitz, 1995). The majority of the firms are avoiding direct competition by pursuing a niche strategy and using long-standing personal ties. For example, 89 percent of the entrepreneurs interviewed about the circumstances of their founding considered the firms in the cluster to be their biggest competitors. But only 14 percent of them considered these local competitors to be a founding risk. Moreover, access to resources derives from social ties associated with personal trust and not from formal cooperation with systemic trust (cf. section 5.2). In Tuttlingen, these social ties and the intensity of local competition are not associated directly with population density. Because in the ecological model cooperation and competition are merely inferred from density, at least in the present case, the interpretation of density dependence in founding activities is not without its problems.

A third explanation of the rejection might be the left truncation in the data set by omitting the early history in the populations' evolution before 1945 (cf. Hannan and Carroll, 1992; Carroll and Hannan 2000). Based on historical documents and sources, we can assume a very low founding activity associated with a low density in the initial period of cluster evolution, from the establishment of the first instrument factory in 1867 to 1900 (cf. figure 8.2). According to Storper and Walker (1989); in an early stage of localization, the firms cannot benefit from localization economies. In this early development stage, complete surgical instruments were manufactured in isolated firms. Thus, there was no division of labor within the cluster and, therefore, virtually no opportunity for cooperation, especially in terms of forward and backward linkages within the local value chain (figure 8.4). The entry barriers for new firms were correspondingly high. From about 1900, specialized suppliers and supporting organizations such as trade associations were established. In this period of clustering, the entry barriers fell considerably because of the localization economies associated with the diversified value chain, and, thus, a higher potential for cooperation within the cluster. In the following period of dispersion, due to increasing competition in the 'mature' product sector, in the early 1970s Tuttlingen firms turned to 'original equipment manufacture' (OEM) suppliers in low-wage countries (Pakistan, Malaysia, etc.). Henceforth, the Tuttlingen firms provide manufacturers abroad with know-how, inputs, and materials, whereas the OEM suppliers provide manufactured and semi-manufactured goods which are finished in Tuttlingen. Since this starting point of mutual global production flows, numerous trading firms have been founded, as well as specialized suppliers and subcontractors who carry out the 'finishing' of semi-manufactured goods for the traders (cf. figure 8.3). In this way, Tuttlingen developed as a kind of global trading hub.

Table 8.2: Cluster-specific institutions in the surgical instrument cluster of Tuttlingen

Institution (year of foundation)	Description
Landesinnung Chirurgiemechanik (1914)	The only craft association of mechanics in surgical instruments in Germany
Gebrüder Martin (1923)	Trade association
Medicon e.G. (1941)	Trade association
Berufliches Bildungszentrum Tuttlingen, BBT (1978)	The only place in Germany to learn the profession of a mechanic in surgical instruments
FORUM Medizintechnik (1989)	Institutionalized platform for technological learning through lectures on innovation, etc.
Ständige Ausstellung von Chirurgie-Instrumenten u. Geräten, ACIG (1992)	A permanent display of surgical instruments and medical appliances
Gewerbepark „take off" (1997)	Technology park, since 2001 focus on start-up firms in the medical technology sector
Kompetenzzentrum Minimal Invasive Medizin + Technik Tübingen-Tuttlingen, MITT (2001)	Competence and technique center for minimally invasive surgery for Tübingen-Tuttlingen
International Business School Tuttlingen (2003)	MBA Medical Device and Healthcare Management

So far, we have discussed time-varying founding conditions and entrepreneurial activity for longer periods. In consideration of the cyclical variation of the founding activity, we also have to look at fast-changing founding conditions influencing the founding activity.

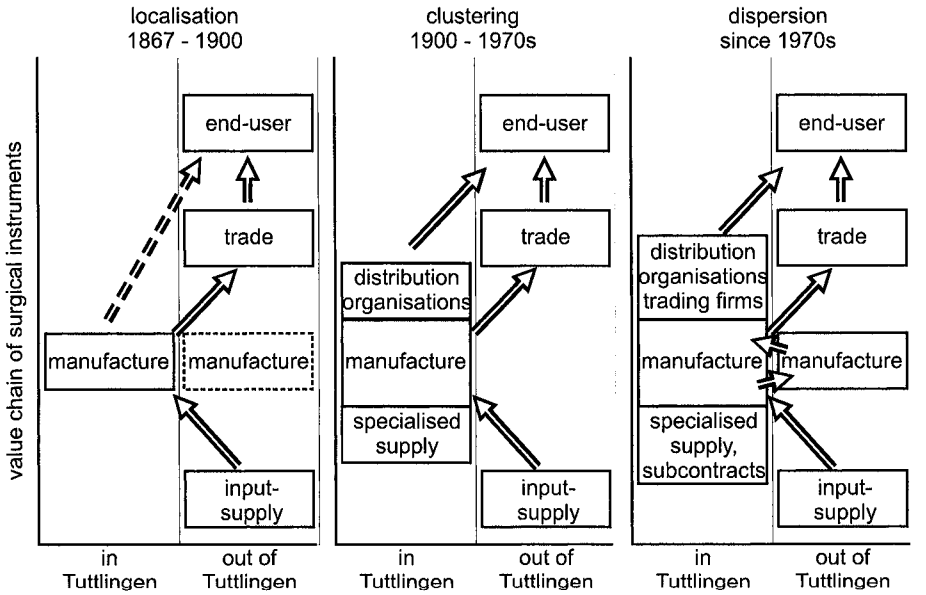

Figure 8.4: The global value chain of surgical instruments at different stages of cluster development

The surgical instrument firms in Tuttlingen have export quotas of up to 85 percent and are, thus, largely independent of the national framework conditions and the national demand for surgical instruments. On the other hand, they strongly depend on international framework conditions, including international demand for surgical instruments and the exchange rate of the US dollar. Periods of dollar decline or historical events like the two world wars influenced the founding activity significantly (cf. figure 8.2). For example, after World War I the striking increase in the founding activity was caused by the redevelopment of foreign markets associated with a favorable exchange rate for US wholesalers because of the hyperinflation in Germany (1920-1922). As a result of the currency reform and the saturation of foreign markets (1923/24-1925), many new firms were established as a matter of need, just as happened five years later because of the world economic crisis. Again, after World War II, there was a catching-up in founding activity associated with the currency reform and the Marshall Plan. According to the experts we interviewed, fluctuations in demand for surgical instruments were initially absorbed by the adjustment of capacity in the existing firms, so that new firms were only founded when these fluctuations in demand became extreme (e.g. the large orders resulting from the Korean crisis). Unlike the variations in quantity of demand, structural changes in demand have direct effects on the number of entries and exits of firms. Thus, the founding boom from 1989-1992 can be explained by the strong demand for new instruments for minimally invasive surgery (MIS). The rapid increase in the number of exits from 1993 onwards can be seen as a result of the increasing quality requirements according to the European Union (EU) medical devices directive.

To sum up the findings in this section, we notice at first that cyclical variations in founding activity were primarily caused by historical events concerning changes in the demand for surgical instruments. Second, periodical variations in founding activity were influenced by organizational changes within the value chain associated with time-varying cooperation and competition. Population density is only an appropriate indicator for measuring time-varying founding conditions for the sub-population of traders. Instead of density, firms' individual strategies and social ties are the crucial factors that have influenced entrepreneurial activity in the evolution of the surgical instrument cluster of Tuttlingen. For this reason, in the following section we describe the social capital of entrepreneurs in detail.

5.2 Social Capital as an Important Founding Condition in the Cluster

Our investigation of the social capital of founders gives us a more detailed picture of the relevance of the social environment for entrepreneurial activity in the case of Tuttlingen. Below, we depict some main findings regarding structural, relational, and cognitive aspects of our network analysis on social capital, and the benefits the founders derive from it.

The analysis of the composition of the ego-centered founder network showed that almost every one of the interviewees could draw on contacts with other entrepreneurs or employees within the industry. Only three of the interviewees did not name entrepreneurs or people with professional experience in the surgical instrument industry. In contrast, 20 of those interviewed named at least one other entrepreneur in the surgical instrument industry, and seven founders had conversations with owners and employees from this industry exclusively.[1]

Advice from members of institutions such as business development agencies, banks, or Chambers of Trade and Industry played hardly any role in discussing topics related to setting up a new firm (cf. table 8.3). Contacts with representatives of banks or chambers mostly involved superficial exchanges. Contacts with the numerous local industry promotion, research and technology transfer institutions[2] were rare exceptions. One explanation for this could be the lack of institutional trust[3] with respect to the institutions located in the cluster, as discussed in the previous section. Many representatives of the institutions had previously worked in one or other of the surgical instrument firms, or have relatives who are working there.

Table 8.3: Number of founders with contacts to institutions since start-up (n=32)

Institutions	No. of founders
Banks	20
Chambers	9
Local or regional industry promotion	4
Kompetenzzentrum Minimal Invasive Medizin + Technik Tübingen-Tuttlingen (MITT)	2
Berufliches Bildungszentrum Tuttlingen (BBT)	2
Others	9

Confidants, with whom there has been exclusive, private contact, have in many cases been acquainted with the founders for a long time. These ties were very often strong ones. Contacts that are exclusively business-related were more often new and ties were weak, but still account for less than half of all ties (cf. figure 8.5).

1 To qualify these results, 12 entrepreneurs from outside the cluster were interviewed. Seven of these said that they had no opportunities for exchanges with other entrepreneurs or employees from their industry and considered this to be a disadvantage. Those who did have such opportunities had exchanges mainly with contacts outside the Tuttlingen region. These were the contacts that were most valuable as sources of information about competitors, products and the industry.

2 As well as the chambers, these are the Landesinnung für Chirurgiemechanik Baden-Württemberg, Forum Medizintechnik Tuttlingen, Kompetenzzentrum Minimalinvasive Medizin and Technik Tübingen (MITT), a Steinbeis Transfer Centre for Medicine and Technology, and other institutions.

3 For a general survey of trust and institutionalized trust see, for example, Hardin (2002).

Concerning the variable 'trust in the contact person', ties that involve great or very great levels of trust proved to be of dominant importance (cf. figure 8.6). Very trustful ties existed in relationships where all topics – including financial questions and names of customers and suppliers – can be discussed. With ties where there was no trust, the founders kept all information to themselves that could be useful to others or that could be damaging if passed on to third parties. Two-thirds of the ties were characterized by cognitive proximity, expressed in common ideas about the surgical instrument industry and/or about independence. In a few ties, there was no cognitive proximity with regard to the industy; however, the different conceptions did lead to innovations. In one-quarter of the cases, communication with and support from the contact suffered from a lack of cognitive proximity from the interviewees' point of view.

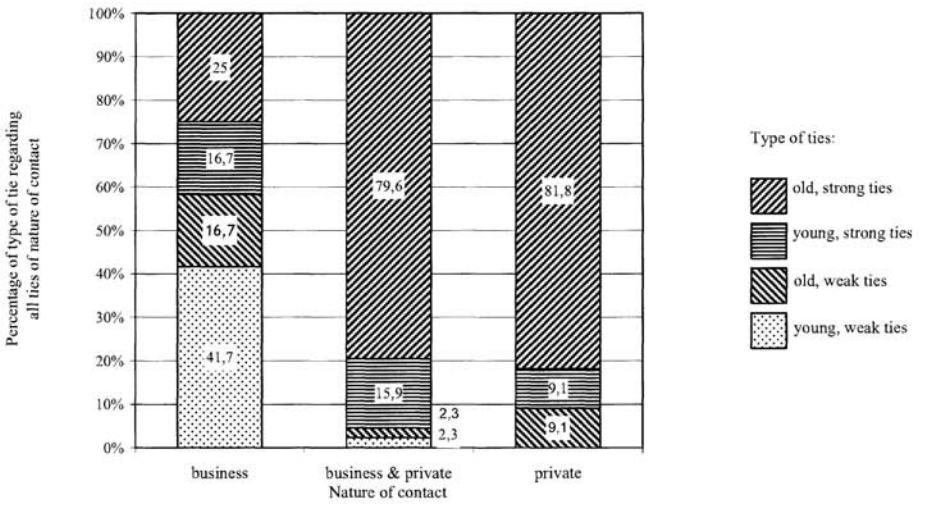

Figure 8.5: Types of founders' ties (n=113 ties)

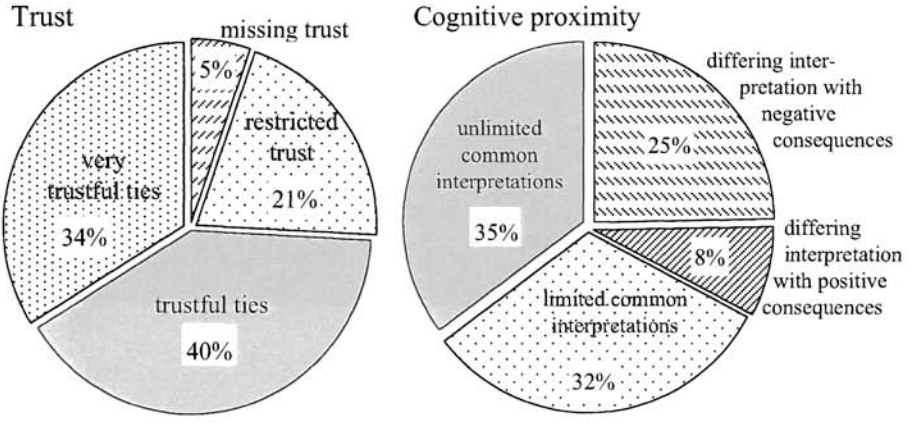

Figure 8.6: Trust (n=112 ties) and cognitive proximity (n=113 ties) in founders' ties

The interviewees often obtained a great variety of support services through their contacts (cf. table 8.4).[4] It is noticeable that almost half of the contacts had provided the entrepreneurs with emotional support. Many founders described this kind of support as very important and they referred to some situations in which emotional support was decisive for them to maintain their independence. Information about the industry and in particular about the local competition ('information on cluster') was received from 29 percent of the ties. The respondents described this information as 'tacit', absolutely necessary, and only available through contacts with industry insiders. This also applies to the know-how of other craftsmen that was obtained through 14 percent of the ties. Unpaid help and general advice were other frequently mentioned forms of support. Other forms of support were seldom received, but in individual cases they were essential for the survival of the start-up.

Table 8.4: Support services derived from contacts (n=116 ties)

Nature of support	derived from ... % of named ties
Emotional support	47
General advice	33
Information on cluster	29
Unpaid activities in founders' firms	18
Know-how transfer	14
Recommendations	6
Material, machinery for free	6
Judicial and fiscal advice	5
Financial resources	4

Analyzing the ties that provide the founders with important detailed information about the industry and local competition, it is evident that the majority gained their information through strong or very strong ties (cf. figure 8.5).[5] This result contrasts with the classical study by Granovetter (1973) on the role of weak ties in the provision of information, but it can be explained by the lack of systemic trust between the actors in the cluster, which greatly hinders an open exchange of information.[6]

[4] In an open question about the locational advantages in the cluster, 12 founders gave support from insiders as the biggest of these.

5 We measured the strength of ties following Burt (1998); that is, ties are stronger, the higher the emotional intensity.

6 This characteristic contrasts with the industrial district literature where widespread trust between local actors is said to be a major basis of interaction and cooperation (e.g. Braczyk et al., 2004).

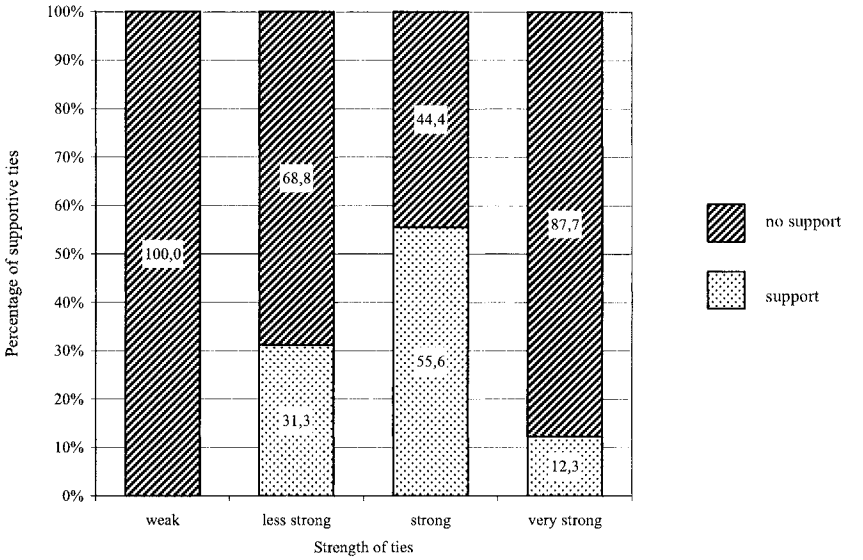

Figure 8.7: Support by strength of ties (n=113 ties)

Our hypotheses regarding relationships between social capital and the success of new firms were tested in two steps. We first calculated correlations and significance tests with the ego-centered network data and evaluated the comprehensive qualitative interview material with particular reference to the significance and function of trust and cognitive proximity. Only very low correlations between social capital and the success of new firms were found with the statistical test of our hypotheses (cf. table 8.5). The results are also very uncertain statistically, and, therefore, they have little informative value.

Despite the lack of statistical evidence for our hypotheses, the qualitative interviews enabled us to recognize the significance of social capital for the success of new firms. The founders considered the trust in their ties to be very important, given the very obvious general mistrust among the actors in Tuttlingen. Accordingly, the interviewed entrepreneurs revealed potentially important information and advice through trustworthy ties only if they were sure that the conversational partner would not pass on any of the information.[7]

7 The great degree of mistrust is expressed, for example, in the fact that no one outside the firm has entry to the production site; that delivery notes are hidden because they contain the addresses of employees; or certification of the firm is delayed so that no external person can find out the names. The collection of the names of contacts originally planned fell through and this initially hindered connecting the ego-centered network of the founder with the networks of the founders. In general, discussions were almost always agreed to on the premise that no names would be mentioned.

Table 8.5: Examples for tested hypotheses

Hypotheses	Indicators	r	p	Ties
The higher the proportion of multiplex ties in the founder's network, the more successful is his resource acquisition	multiplexity, resource acquisition	0,04	0,66	111
The higher the portion of trust-based ties, the more successful the start-up	trust, annual change of turnover	0,12	0,21	106
The higher the portion of trust-based ties, the higher the probability of support by means of unpaid help	trust, unpaid help	0,17	0,35	112
The higher the portion of ties characterized by cognitive proximity, the more successful the new firm	cognitive proximity, annual change of turnover	0,05	0,63	107
The higher the portion of ties characterized by cognitive proximity, the higher the probability of situational support	cognitive proximity, situational support	0,08	0,86	113
The more experience in the surgical instrument business a founder has, the more successful his resource acquisition	experience, resource acquisition	0,08	0,64	32 founders

And I don't trust this employee even though we are related. He keeps on saying "I'll be an entrepreneur myself one day." And when he knows everything about my business, he will go into business himself and take my customers with him. That's the problem in Tuttlingen, a lot of people become entrepreneurs themselves [...]. That's why I don't let anyone answer the phone except the apprentice. Letting all my employees answer the phone would mean letting things get out of control. (Interview 22)

Interviewees took extreme care with the names of suppliers and customers. Those names were disclosed only in extremely trustworthy and mostly long-term relationships. But if there was trust, the ties enabled the founders to get access to information otherwise kept secret.

He [a friend] has always worked in a competing company. [...]It is a very close and trustworthy relationship. Sometimes we talk about things that should never have been a subject for discussion. That's why both sides have to be absolutely sure that such information won't be passed on. [...] Utilize information, exploit it, but shield the source and keep it secret. (Interview 13)

As a result of the given information, advice and other support tailor-made for the current situation, respondents often saw network ties which are characterized by great cognitive proximity as more helpful than services provided by management consultants – combined with considerably lower costs of such relations. Twelve of the interviewees succeeded in surviving difficult phases during the establishment of their firms with the support of people who were able to assess the situation correctly because of their experience. The precondition that enabled the advantages of cognitive proximity to be used was the trust in this relationship.

Other results also show how important social capital is for the firm's founder. In nine of the 32 cases, the contacts had motivated the nascent entrepreneur to become independent, and they helped them to do so right from start. In 26 cases, founders obtained support through their network that resulted in considerable cost reductions and/or sales increases. In the following example, a contact helped the entrepreneur to achieve exceptionally large increases in sales so that the new firm was able to become a market leader in terms of sales within a few years.

I said to my business contact "I don't have the money for a huge stock". My contact said, "Can I help you in any way?" I said, "You could give me some money if you'd like." Then I got 100,000 Euros without a guarantee. My contact simply transferred 100,000 to my account. (Interview 35)

In 20 cases, respondents got advice, guidance and information about the local market that would be otherwise inaccessible, and which they considered to be very valuable.

"It's not the same as in other business sectors. You can draw up the most beautiful business plans. Your customers don't bother about your graphs if you don't have any personal contacts and experience in the surgical instrument business. If somebody enters the local market as an outsider, he'll fall flat on his face."
(Interview 18)

To summarize, it can be stated that concerning the importance of trust and cognitive proximity, trust in the interviewees' ties was a necessary condition for getting any support, and cognitive proximity between the network partners increased the effectiveness of that support. In many cases, trust and cognitive proximity made up a significant element in the social capital of founders that, in many completely different situations, was itself decisive for the success of the new firm.

6. Access to Critical Resources through Personal Contacts in an Environment of Intense Competition

In this chapter we have examined the socio-economic processes and mechanisms related to the entrepreneurial activities in the surgical instrument cluster of Tuttlingen. The entrepreneurial activity within the cluster was affected by a range of socio-economic founding conditions. Due to the high export orientation of the cluster, national framework conditions had virtually no effect on the founding activity. In contrast, the industry-specific and cluster-specific framework conditions did have and still do have a large influence. In particular, historical events concerning changes in the quantity and quality of demand for surgical instruments caused cyclical variations in founding activity. In addition, periodical variations in founding activity were caused by changing barriers to entry during the different stages of cluster evolution. Changes in the value chains associated with disequilibria of cooperation and competi-

tion affected access to critical resources, and, thus, influenced barriers to entry. Thus far, the social capital of entrepreneurs played a decisive role in securing access to the relevant resources, and, thus, was one factor in the success of business start-ups. Most of the founders interviewed fell back on strong ties, which were characterized by multiplex business and private interests and great personal trust. The majority of the contacts were embedded in the surgical instrument cluster themselves, and, therefore, were able to support the founders with particularly suitable resources, including tacit knowledge, information on local competitors, and situational advice. The latter indicated the advisors' ability to put themselves in the position of the founders, thanks to their cluster and industry-related knowledge. The prevalence of strong and trustful ties in founders' networks is very remarkable, since the social environment in the cluster is contrasted with great mistrust among the actors. It was precisely these trusted contacts that provided the founders with critical resources.

Of course, by reason of the case study design in this investigation, our results lack theoretical significance. A study of comparable clusters and a comparison with entrepreneurial activity outside clusters should, therefore, be the next step to improve the generality of these results.

References

Adler, P.S., Kwon, S-W., 2002, Social Capital: Prospects for a new concept. *Academy of Management Review,* 27, 17-40.

Aldrich, H., Zimmer, C., 1986, Entrepreneurship through social networks. In *Population Perspectives on Organizations,* H. Aldrich, E.R. Auster, U. Staber, C. Zimmer, (eds) Uppsala.

Amin, A., Thrift, N., 1995, Institutional issues for the European regions: From markets and plants to socioeconomics and powers of associations. *Economy and Society*, 24, 41-66.

Bachmann, R., 2003, The role of trust and power in the institutional regulation of territorial business systems. In *Cooperation, Networks, and Institutions in Regional Innovation Systems,* D. Fornahl, T. Brenner, (eds) Cheltenham, Northampton, MA.

Baum, J.A.C., Haveman, H.A., 1997, Love thy neighbor? Differentiation and agglomeration in the Manhattan hotel industry, 1898- 1990. *Administrative Science Quarterly*, 42, 304-338.

Boschma, R.A., 2005, Proximity and innovation. A critical assessment. *Regional Studies*, 39, 61-74.

Bosma, N., van Praag, M., Thurik, R., de Wit, G., 2002, The Value of Human and Social Capital Investments for the Business-Performance of Startups, Tinbergen Institute Discussion Papers TI 2002-027/3.

Braczyk, H-J., Cooke, P., Heidenreich, M., 2004, *Regional innovation systems. The role of governances in a globalized world.* 2nd edition. London, New York: Routledge.

Britton, J.N.H., 2004, High technology localization and extra-regional networks. *Entrepreneurship and Regional Development*, 16, 369-390.

Brüderl, J., Preisendörfer, P., 1996, Network support and the success of newly founded businesses. *Small Business Economics*, 10, 213-225.

Bühler, C., 1999 *Die strukturelle Eingebundenheit neugegründeter Unternehmen*, München.

Burt, R.S., 1998, Short form of the sociometric questionnaires to measure social capital of managers and other professionals. University of Chicagos Graduate School of Business.

Burt, R.S., Hogarth, R.M., Michaud, C., 2000, The Social Capital of French and American Managers. *Organization Science*, 11(2), 123-147.

Carroll, G.R. Organizational ecology. *Annual Review of Sociology* 1984, 10: 71-93.

Carroll, G.R., Hannan, M.T., 2000, *The Demography of Corporations and Industries*. Princeton, NJ.

Coleman, J.S., 1990, *Foundations of Social Theory*, Cambridge. MA, London.

Dei Ottati, G., 1994, Trust, Interlinking Transactions, and Credit in the Industrial Districts. *Cambridge Journal of Economics*, 18, 529-546.

Enright, M. J., 2003, Regional Clusters: What we know and what we should know." In *Innovation Clusters and Interregional Competition,* Bröcker J., Dohse D., Soltwedel R., (eds) Springer Verlag.

Feldman, M.P., 2001, The entrepreneurial event revisited: Firm formation in a regional context. *Industrial and Corporate Change*, 10(4), 861-891.

Fornahl, D., 2003, Entrepreneurial activities in a regional context. In *Cooperation, Networks, and Institutions in Regional Innovation Systems,* D. Fornahl, T. Brenner, (eds) Cheltenham.

Fornahl, D., Menzel, M.P., 2002, Co-development of firm foundings and regional clusters. Paper presented at the 2nd International GET UP-Workshop on University-Based Start-Ups; 2002 April 11-13; Jena.

Fritsch, M., Grotz, R., 2002, *Das Gründungsgeschehen in Deutschland: Darstellung und Vergleich der Datenquellen.* Heidelberg.

Gordon, I.R., McCann, P., 2000, Industrial clusters: complexes, agglomeration and / or social networks? *Urban Studies*, 37(3), 513-532.

Grabher, G., Stark, D., 1997, Organizing Diversity: Evolutionary Theory, Network Analysis and Postsocialism. *Regional Studies*, 31, 5, 533-544.

Granovetter, M., 1973, The strength of weak ties, *American Journal of Sociology*, 78, 1360-1380.

Granovetter, M., 1985, Economic action and economic structure: The problem of embeddedness. *The American Journal of Sociology*, 91, 481-510.

Halder, G., 2004, Local upgrading strategies in response to global challenges: The surgical instrument cluster of Tuttlingen, Germany. In *Local Enterprises in the Global Economy: Issues of Governance and Upgrading.* Schmitz, H., (ed) Cheltenham.

Halder, G., 2005, Chirurgische Instrumente aus Tuttlingen und Sialkot/Pakistan: Lokale Produktion für den Weltmarkt. *Geographische Rundschau*, 2, 12-20.

Hannan, M.T., Carroll, G.R., 1992, *Dynamics of Organizational Populations: Density, Legitimation, and Competition.* New York.

Hannan, M.T., Freeman, J., 1989, *Organizational Ecology*. Cambridge, MA.

Hardin, R., 2002, *Trust and trustworthiness*. Russell Sage Foundation series on trust, volume IV, New York: Russell Sage Foundation.

Inkpen, A.C., Tsang, E., 2005, Social Capital, Networks, and Knowledge Transfer. *Academy of Management Review*, 30, 146-165.

Knoke, D., 1994, Networks of elite structure and decision-making. In *Advances in Social Network Analysis*. Wasserman, S., Galaskiewicz, J., (eds) Thousand Oaks.

Krugman, P., 1991, *Geography and Trade*. Cambridge, MA.

Larson, A. L., 1992, Network Dyads in Entrepreneurial Settings: A Study of the Governance of Exchange Relationships. *Administrative Science Quarterly*, 37, 76-104.

Liebeskind, J. P., Oliver A. L., Zucker, L.; Brewer, M., 1996, Social Networks, Learning, and Flexibility: Sourcing Scientific Knowledge in New Biotechnology Firms. *Organization Science*, 7, 429-443.

Lorenzen, M., 2001, Ties, Trust, and Trade. *International Studies of Management and Organization*, 31, 14-34.

Marsden, P., 1990, Network data and measurement. *Annual Review of Sociology*, 16, 435-463.

Marshall, A., 1890, *Principles of Economics*. London.

Martin, R., Sunley, P., 2003, Deconstructing clusters: Chaotic concept or policy panacea? *Journal of Economic Geography*, 3, 5-35.

Maskell, P., Malmberg, A., 1999, Localised learning and industrial competitiveness. *Cambridge Journal of Economics*, 23, 167-185.

Maurer, I., 2003, *Soziales Kapital als Erfolgsfaktor junger Unternehmen - Eine Analyse der Gestaltung und Entwicklungsdynamik der Netzwerke von Biotechnologie Start-ups*. Wiesbaden: Westdeutscher Verlag.

Meuser, M., Nagel, U., 1991, ExpertInneninterviews – vielfach erprobt, wenig bedacht – Ein Beitrag zur qualitativen Methodendiskussion. In *Qualitativ-empirische Sozialforschung*. Garz, D., Kraimer, K., (eds) Opladen.

Meyer, J.W., Rowan, B., 1977, Institutionalized Organizations: Formal Structure as Myth and Ceremony. *American Journal of Sociology*, 83, 340-363.

Nadvi, K., Halder, G., 2002, Local Clusters in Global Value Chains: Exploring Dynamic Linkages Between Germany and Pakistan. Institute of Development Studies *(IDS) Working Paper* 152, Institute of Development Studies, Brighton.

Nahapiet, J., Ghoshal, S., 1998, Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 32, 242-266.

Nooteboom, B., 1999, The Triangle: Roles of the Go-Between. In *Corporate Social Capital and Liability,* R. T. Leenders, S.M. Gabbay, (eds) Boston.

Porter, M.E., 1998, Clusters and the new economics of competition. *Harvard Business Review*, 6, 77-90.

Porter, M.E., 2000, Locations, Clusters, and Company Strategy. In *The Oxford Handbook of Economic Geography*. Clark, G.L., Feldman, M.P., Gertler, M.S., (eds) New York.

Portes, A., 1998, Social Capital: Its Origins and Applications in Modern Sociology. *Annual Review of Sociology*, 24, 1-24.

Putnam, R.D., 2000, *Bowling Alone. The Collapse and Revival of American Community*. New York: Simon and Schuster.

Rosenfeld, S.A., 1997, Bringing Business Clusters into the Mainstream of Economic Development. *European Planning Studies*, 5, 3-23.

Rowley, T., Behrens, D., Krackhardt, D. (2000), Redundant Governance Structures: An Analysis of Structural and Relational Embeddedness in the Steel and Semiconductor Industries, in: *Strategic Management Journal*, 21, 369-386.

Saxenian, A. *Regional Advantage - Culture and Competition in Silicon Valley and Route 128*. Cambridge, MA: Harvard University Press, 1994.

Schmitz, H., 1995, Collective Efficiency: Growth Path for Small Scale Industry. *Journal of Development Studies*, 31(4), 391-411.

Singh, J.V., Lumsden, C.J. Theory and Research in Organizational Ecology. *Annual Review of Sociology* 1990, 16: 161-195.

Sorenson, O., Audia, P. G., 2000, The social structure of entrepreneurial activity: Geographic concentration on footwear production in the United States. *American Journal of Sociology*, 106(2), 424-462.

Staber, U., 1997, An ecological perspective on entrepreneurship in industrial districts. *Entrepreneurship and Regional Development*, 9, 45-64.

Steier, L., Greenwod, R., 2000, Entrepreneurship and the evolution of angel financial networks. *Organization Studies*, 21(1), 163-192.

Sternberg, R., 2004, Litzenberger, T. Regional clusters in Germany? Their geography and their relevance for entrepreneurial activities. *European Planning Studies*, 12(6), 767-791.

Storper, M., Walker, R., 1989, *The Capitalist Imperative. Territory, Technology, and Industrial Growth.* Oxford, Cambridge, MA.

Storper, M., 1993, Regional 'Worlds' of Production: Learning and Innovation in the Technology Districts of France, Italy and the USA. *Regional Studies* 1993, 27(5): 433-455.

Storper, M., 1997, *The Regional World. Territorial Development in a Global Economy*. New York, London.

Talmud, I., 1999, Corporate Social Capital and Liability: A Conditional Approach to Three Consequences of Corporate Social Structure. In *Corporate Social Capital and Liability R.T.A.J.* Leenders, J., Gabbay, S.M., ed. Boston.

Tsai, W., Ghoshal, S., 1998, Social capital and value creation: The role of intrafirm networks. *Academy of Management Journal*, 41(4), 464-476.

Uzzi, B., 1996, The sources and consequences of embeddedness for the economic performance of organizations: The network effect. *American Sociological Review*, 61, 674-698.

Wasserman, S., Faust, K., 1994, *Social Network Analysis: Methods and Applications*. Cambridge: Cambridge University Press.

Westlund, H., 2003, Bolton, R. Local social capital and entrepreneurship. *Small Business Economics*, 21, 77-113.

Williamson, O.E., 1975, *Markets and Hierarchies*. New York: Free Press.

9 STRUCTURAL COUPLINGS OF YOUNG KNOWLEDGE-INTENSIVE BUSINESS SERVICE FIRMS IN A PUBLIC-DRIVEN REGIONAL INNOVATION SYSTEM

The Case of Bremen, Germany*

Knut Koschatzky and Thomas Stahlecker

1. Introduction

The knowledge economy presents an essential challenge for regional innovation systems, which are modernizing or renewing themselves. The main focus in knowledge-driven innovation systems is on the organizational change in innovation activities as well as on general structural shifts within the system, which are linked to the ever intensifying international division of labor and growing knowledge basis of economic and industrial activities (Miles, 2003). Closely bound to these structural shifts are new forms of knowledge generation, knowledge transfer, and the activation of new, respectively unexploited technology and knowledge potentials. At least in mature economies, structural change shows service-oriented traits and is characterized by knowledge orientation and an increasing role of new firm formation in knowledge-intensive business services (KIBS). Thus, in the last decades a dynamic development can be observed in this economic field (cf. Kerst, 1997). These developments combine several sub-trends – shifts in the management philosophy (e.g. trends towards 'leaner' firms, outsourcing of functions, and towards a greater emphasis on customer relationships), structural shifts in the composition of demand, and unevenness in the application of new technologies to product and process innovation (Illeris, 1996; Miles, 2000; Tether, 2003).

* We are particularly indebted to the firm founders spending their time for answering our questions. Without the grant of the German Research Foundation for the project "The foundation of knowledge-intensive business services in the context of industrial core regions: a comparative analysis in a regional economic perspective" the present contribution would not have been possible. We also thank two anonymous referees for their valuable comments.

The dynamics in these higher-quality service segments is often generated via the demand of existing enterprises for new, advanced, knowledge-intensive, and specialized services. For instance, manufacturing firms increasingly rely on external services which can provide a number of support functions in the process of adapting to structural change which include: increasing flexibility, intensifying specialization, product differentiation tailor-made to customer needs, concentration on core activities, internal reorganization, cost cutting, quality improvements, better access to information capabilities, expert knowledge or new technologies, as well as the search for new markets. Immaterial elements and inputs to the value added chain are involved here, as already described by Klodt et al. (1997). These inputs from the service sector are gaining more and more significance compared to material investments.

From a regional point of view, policy-makers have discovered KIBS as an essential and system-bridging actor group, which could actively contribute to regional development and change (Almus et al., 2001; Meyer-Krahmer and Lay, 2001; Wood, 2002). Assuming that the more the public sector is able to support KIBS formation through the promotion of spin-offs from public research organizations or through the provision of supportive framework conditions like public funding, the stronger it can govern the structural ties and, thus, the regional integration of KIBS and their contribution to the regional economy. In this respect, it appears important to shed some light on the aspect of knowledge transfer, spatial proximity (e.g. the significance of the regional environment for new KIBS formation) and the early development process of KIBS. Various differences concerning the importance of proximity or the necessity of a geographical co-location to potential knowledge-providers can be assumed in regard to the very heterogeneous group of firms within the KIBS sector (Czarnitzki and Spielkamp, 2003).

Most of the research dealing with KIBS originates predominantly in business administration or economics. Studies focus, for example, on innovation activities in the service sector in general (Miles et al., 1995), on the interrelationships between SMEs or the manufacturing sector and KIBS (Muller, 2001), and on the importance of KIBS under aspects of regional economic development and structural change (Fritsch and Mueller, 2004; Muller and Zenker, 2001). Other studies analyzed, for instance, start-up intensities, sectoral structures, and regional distribution of newly founded KIBS (Almus et al., 2001, Santarelli and Piergiovanni, 1995). Even though important factors with regard to start-up, survival, and growth processes have been identified by generating large statistical data (Fritsch and Grotz, 2002; Fritsch and Niese, 2004), firm-level investigations have been the exception.

This contribution is designed to close a gap in existing research. It is part of a larger project analyzing "the foundation of knowledge-intensive business services in the context of industrial cores," jointly carried out by Fraunhofer Institute for Systems and Innovation Research (Karlsruhe) and the Institute of Applied Economic Research (Tübingen), funded by the German Research

Council. In this project, the interrelations between regional innovation systems and the patterns of firm formation in the KIBS sector, the preconditions and the determinants of start-up-processes, regional differences of the start-up patterns and firm characteristics, and the determinants of the post-entry growth of KIBS have been analyzed.

This paper focuses on the structural ties of newly founded or young KIBS with regard to their integration into a regional innovation system and on the role these structural couplings could play in regional modernization. Based on a review of earlier studies, research questions are developed, which serve as guideline for the empirical analysis (section 2). The approach of a case study is used to illustrate the interrelations of KIBS with their economic environment. Due to its well developed public research and innovation system and recent policy shifts towards the stronger stimulation of KIBS formation, the region of Bremen, a small federal state located in northern Germany, serves as a case study for an innovation system in which KIBS could play an important role in knowledge and technology transfer and in linking the research system with the market (sections 4 to 6). Conclusions related to the research questions will conclude the paper in section 7.

2. Service-Oriented Structural Change, Knowledge Orientation and Enterprise Foundations: Theoretical Background

In the future, regional competitiveness will increasingly depend on the extent to which endogenous knowledge and technology potentials are successfully activated and converted into value added. This can take place within the framework of the innovation process of already existing enterprises, but also – and this will become crucial in knowledge-based economies – in connection with start-ups. Besides corresponding impacts for the economy as a whole, innovative new firms possess all of the important functions with regard to the regional structural change or technological and knowledge modernization process. Thus, for example, high start-up rates are regarded as necessary for the techno-economic change in 'old' manufacturing regions (Hamm and Wienert, 1990). High start-up rates and the technical advances at least partly driven by innovative new firms are often connected with high rates of innovation and an increase of efficiency, whether it is in the new or in the incumbent firms (Geroski, 1995, 431)

New firm formation in the knowledge-intensive service sector plays a significant role in the exploitation of regional knowledge. The function in the innovation processes and innovation systems attributed to this enterprise type is largely undisputed (cf. Miles et al., 1995; Bilderbeek and den Hertog, 1998). A great number of studies deal with the *innovation impulses* for industrial production emanating from knowledge-intensive service companies. It is em-

phasized that the development of production and services are inter-linked to a high degree and are mutually interdependent. Closely meshed integration or association between production and services are a crucial component of new organizational forms of industrial relationships (Meyer-Krahmer and Lay, 2001; Muller, 2001; Hipp, 2000; Schamp, 2000). Knowledge-intensive services provide new possibilities for a division of labor and important intermediary inputs for firms in manufacturing as well as for service sector firms.

Knowledge-intensive business service firms are knowledge-intensive in the sense that their fundamental key tasks are to be seen in knowledge diffusion and utilization as well as in the integration of various knowledge stocks and competences (Strambach, 2001, 62-63; Antonelli, 1999, 254). They act as transmission agents in knowledge processes and are characterized, particularly, by a knowledge-intensive and human capital-intensive performance. Muller and Zenker (2001, 1504), Muller (2001) and Lo (2003, 7) identify the following characteristics of knowledge-intensive service providers:

(1) the output combines highly specialized and up-to-date knowledge in the form of problem-specific solutions,
(2) the tasks are performed in the framework of intensive interaction and co-operation between supplier and customer, and
(3) the work performed is client-specific, of high quality, comparatively complex, and exhibits only a low degree of specialization.

The quantitative and qualitative dimension of start-ups depends decisively, however, on the inter-relationships within a regional innovation system (Cooke, 2004). Almus et al. (2001) demonstrate that regional supply and demand conditions exercise a decisive influence on the regional start-up intensity. Besides the size of the region (number of inhabitants, number of employees), the endowment with firm formation relevant characteristics and their systemic interactions affect the number and the development of new enterprises (Nerlinger, 1998, 57). The most important factors which influence the regional entrepreneurial activities are (according to Bergmann, 2004; Niese, 2003; Sternberg, 2000; Malecki, 1994, 1997; Birch, 1987):

- the amount, types, and mix of incubator organizations (e.g. private companies, R&D institutions, universities etc.),
- the entrepreneurial atmosphere; for instance present entrepreneurs may serve as role models or examples for new entrepreneurs,
- the technological regimes (entrepreneurial versus routinized regimes),
- the social mix of places, especially regarding educational level,
- the region's ability to attract and retain educated people and also entrepreneurs,
- the quality of government and public support measures for entrepreneurship, and

- the existence of intermediary institutions and the provision of financing (private financing institutions and public banks).

In this respect, public governance of new firm formation can play an important additional role in regional development. 'Entrepreneurial regions' are, thus, distinguished by a favorable combination of technological, industrial, social, institutional, and other 'soft' factors.[1] Such regions do not only exercise a positive influence on the level and the dynamics of start-up activities, but also assume an important stabilizing function for enterprises in their early life phase (cf. also Reynolds et al., 1994). Typically, it is the urban agglomerations which dispose characteristic features for stimulating start-ups and which are favored spaces for public governance with regard to fostering entrepreneurship. For Malecki (1994), agglomeration advantages cause urban spaces to be the preferred sites for technology-intensive and knowledge-intensive start-ups (for a recent empirical analysis of new firm formation in cities see Fritsch et al., 2004).

The start-up process is designed, first of all, on the basis of highly specialized knowledge linked to specific persons (Miles, 2003, 88). The phase of early enterprise development is then characterized by extensive interactive knowledge generation processes. Collective learning processes play a decisive role in this phase, on the one hand, because of limited possibilities to procure and process new knowledge, which can be attributed to size disadvantages, and, on the other hand, due to the necessity of interaction between knowledge-suppliers and clients. Knowledge is initially generated interactively, and as a result it is specific to certain relationships and embedded in social and cultural contexts (Lundvall and Johnson, 1994, 30). According to Meusburger (2000) embedded knowledge can neither be easily acquired nor transferred to another location. It is only accessible to service providers in this spatial and social context.

Due to the mentioned characteristics of KIBS, which include the specific problems involved in the start-up process and the spatial ties to implicit knowledge stocks, the relationships have the form of networks. The integration of knowledge-intensive service companies in networks (Hauknes, 1998) can be decisive for success and survival, especially for newly started enterprises. Above all, relationships in R&D as well as contacts to customers in manufacturing and to other (knowledge-intensive) service firms may be important in this context. Kujath (1998) emphasizes that with increasing specialization and knowledge orientation in enterprises, their ability to perform all necessary tasks in-house decreases, and, therefore, the necessity to outsource to external providers increases. The significance of the quantitative and qualitative structural features of the location plays an important role. Reasons for regional ties of KIBS can generally be found in the spatial arrangement of these network

1 According to Malecki (1997, 61) the soft factors "the elements of local/regional economic structure – labor, industrial, and social characteristics – go part-way in explaining geographical variations in innovation and entrepreneurship."

relationships, but also in the dependency of their knowledge stocks on a certain spatial context (Stehr, 1994).

The connections between personal contact, building of knowledge networks and spatial proximity are discussed in spatial network research (cf. Malmberg and Maskell, 1997, 31-32; Staber, 1996, 150-152). It is argued that spatial proximity requires not only spontaneous, frequent personal contacts but also the development of a common social context with specific patterns of trust and behavior standards (cf. Koch and Stahlecker, 2004). Communication, in particular, is seen as a fundamental pre-condition for intended knowledge exchange and, thus, for the output of service networks (cf. Lo, 2003, 107). It can, therefore, be expected that structural coupling in regional modernization processes refers to forms of social communication which are formed or only made possible by the institutional framework conditions in the respective regional innovation system (cf. Koch and Stahlecker, 2005).

The aforementioned observations suggest that young knowledge-intensive business service firms exhibit close ties to their region from functional and structural points of view. Structural couplings to the regional innovation system are formed essentially through the predominant supply and demand conditions. Spatial and social proximity play a decisive role here. On the one hand, knowledge-intensive service firms, at least in the early phase of their entrepreneurial existence, depend on proximity to important customers (and other actors) in order to provide services. On the other hand, start-ups are forced to network with external resources, which may be conducive for their development. Keeping this in mind, the following research questions will guide our empirical investigation:

(1) What is the *institutional background* of KIBS start-ups in the regional innovation system of Bremen? What role is played, in particular, by the university, the technical universities and colleges, respectively the non-university research institutions and regional enterprises as incubator organizations?

(2) Which regional *framework settings* have an overall positive impact on the start-up activities of knowledge-intensive service firms? How do young enterprises of this type assess their location as a region for start-ups? Which factors hinder or delay the founding and early development process?

(3) What type of regional *demand condition* is a characteristic for young knowledge-intensive service companies? What may be the role of 'industrial cores' in this respect? How are the service firms linked to their suppliers and customers?

(4) Which *knowledge-oriented and technological* ties exist between new firms and the established companies? Do regional ties even play a notable role?

3. Methodological Approach

In order to examine the outlined questions, we conducted a standardized survey in the form of telephone based interviews with the founders of newly founded KIBS. In addition to the survey approach, we conducted semi-structured personal interviews with relevant actors in the respective regions (for this methodology see, for example, Healey and Rawlinson, 1993; Vaessen and Wever, 1993). We chose interviewees from two groups: on the one hand, experts from the business sector, from science, and from the (regional) administration. On the other hand, interviews were conducted with founders of KIBS. Our principal aims were (1) to obtain deeper insights into the internal structure of the KIBS sector and its linkages and interdependencies with the (regional) economy and (2) to acquire a profound picture of the region-specific circumstances (for a detailed review of the qualitative study see Koch and Stahlecker, 2005).

Table 9.1: Structure of the sample

Companies addressed	122
- companies not found	9
- company no longer exists	3
Interview did not occur / was refused	55
Interviews conducted	55 (= 46%)

For the telephone survey, a stratified sample of 122 KIBS was constructed reflecting the structure of the KIBS start-ups in Bremen (see section 5).[2] Each of these KIBS was sent a letter, announcing that they would be asked to participate in telephone interviews. 55 interviews were conducted with managers and founders of knowledge-intensive business service firms (cf. table 9.1). The founders' participation in the telephone interviews was relatively high (46 percent). The main reasons for refusing the interview were "time restrictions" and "no interest in taking part in surveys." It must be pointed out that due to the low number of cases, the results can not be regarded as representative. In addition, the investigation faces the problem of a survivor bias. This is due to the fact that only companies who still existed were taken into consideration and that the survey period covered the period from 1992 to 2003. A comparison with the total population of KIBS start ups in the region did not indicate any systematic bias in the sample. The majority of KIBS firms, in our sample, is related to NACE group 72 ("software and databases") and 74.1 (tax, legal, and business consultants, auditors and opinion pollsters). Nevertheless, the survey allows an insight into structures and dynamics of the KIBS

2 In addition to the Mannheim Start-Up Panel, the Statistical Office Bremen provided information about the stock of KIBS firms in Bremen.

sector in the region of Bremen. The sector of knowledge-intensive business service firms can be subdivided into technology-oriented services and *non-technical consulting firms* (or non-technology-based, knowledge-intensive services) (e.g. Engel and Steil, 1999; Bilderbeek and den Hertog, 1998; Nerlinger, 1998). Based on the results of the Mannheim Innovation Panel, Engel and Steil (1999) have differentiated technology-based services according to the level of their innovation activities. Among these belong: telecommunications (NACE code 64.2); data processing and databases (72), architecture and engineering bureaux (74.2); technical, physical, and chemical testing (74.3) as well as research and development (R&D) in natural, engineering, agricultural sciences, and medicine (73.1). On the other hand, non-technology-based, knowledge-intensive service firms such as tax, legal, and business consultants, auditors and opinion pollsters (74.1), research and development in the field of law, economics and social sciences (73.2), as well as advertising firms (74.4) primarily apply technology in pursuit of their service activities (e.g. IC technologies). These industries were selected for the empirical investigation.

The essential characteristics of the sample are:

- Age *structure*: roughly 62 percent of the KIBS (= 34) were founded in 1996 and later; roughly 22 percent in the period from 1992 to 1995; thus, mainly young enterprises were questioned.
- *Employee structure*: above all, the sample is characterized by the dominance of small and very small firms; a good 67 percent (= 37) of the firms have 10 or less employees, or they are only comprised of founders; few large companies were questioned: one enterprise with 410 employees as well as one with 170 employees.
- *Growth of the young firms (1996 and younger)*: approximately one quarter of the KIBS aim to achieve turnovers of up to circa 5 million Euros in the next five years; 30 percent of the firms did not provide information here or left the amount open; on the whole, these facts coincide with the impression already gained in section 3 that only very few growth-oriented 'champions' are found among the start-ups, which will show considerable growth.
- *Research and development*: at any rate, 72 percent of the KIBS conduct own R&D – only 28 percent did not perform any R&D. It should, however, be mentioned - this is shown by a whole series of empirical investigations with a similar thematic background - that a considerable number of firms carry out quite intensive innovation activities, even without their own R&D. R&D is performed above all in the following areas: software development, database development, microsystems technology and sensors, biotechnology, gene analysis, sonar and radar technology, multimedia development, systems integration, aquaculture, water treatment, environment-technical analysis and evaluation procedures, graphic design, Internet design, design, metrology etc.

4. The Regional Innovation System of Bremen as a Case Study

Bremen is located about 100 kilometers southwest of Hamburg, in the northwestern part of Germany. The city of Bremen has 660,000 inhabitants in an area of 404 km², resulting in a population density of 1,633 inhabitants/km². Its GDP per capita is 49 percent higher than the EU-25's average, while the GDP growth in the years from 1995 to 2001 was relatively low at only 1.5 percent annually. Bremen is one of the 16 federal states in Germany with all of the autonomy this status offers. Bremen's "Senat" is an elected government that has its own legal and financial rights. The Senator for Education and Science and the Senator for Economic Affairs and Ports are the major actors in R&D and innovation policy, and they have the opportunity to execute their own support programs. The region's R&D expenditures reached 2.13 percent of GDP in 2003 (BMBF, 2004). The share of private and public expenditures is nearly identical. Since the ratio between public and private R&D expenditures is 1/3 to 2/3 for Germany as a whole, Bremen is characterized by a relatively high share of the public sector in financing R&D activities.

In recent years, the regional government implemented a policy framework program called "InnoVision 2010" (Free Hanseatic City of Bremen, 2004). Within this program, future-oriented innovation fields were defined such as medicine and health, environmental technologies, logistics, ICT, and design in which knowledge-intensive service activities can be expected to play a fundamental role for the further economic development of the region. It is the political will to improve the interfaces between the research and the industrial sector and to stimulate an entrepreneurial climate in the region. Due to these governance competencies and the strong influence of public decisions on the structure and development of the regional innovation system (in a way like the type "Localist-Network" according to Cooke, 2004), Bremen was taken as a case study for illustrating the role young KIBS could play in a small regional economy and for shedding some light on the structural couplings and regional integration of this type of firm.

The Bremen region is characterized by a below average R&D-intensity of the manufacturing sector, although a few exceptions exist. For example, Bremen is one of the most important locations for the German aerospace and aeronautics industry. In Bremen, about 1,800 people are employed in this rather innovative industry which accounts for about 40 percent of all German employees in this sector. European Aeronautic Defence and Space Company (EADS) is a key player, but other R&D-intensive SMEs are active in this field as well. But in general, manufacturing enterprises are characterized by little in-house R&D activities (Koschatzky et al., 2004). In addition, the few 'big players' of Bremen's manufacturing sector are subsidiary plants with no or little R&D activities (e.g. steel industry, automobile industry, food production). Since the manufacturing high-tech activities are mainly isolated islands

with regard to their intraregional economic integration, a small potential for business service outsourcing or a significant demand for knowledge-intensive services from external (new) firms exists.

The structure of the knowledge-intensive business services sector is as follows: The largest groups are legal, tax, and business consultants, market and opinion research as well as the equity investment companies with approximately 8,600 employees followed by architecture firms and engineering consultants with about 3,400 employees. Software firms rank third (approximately 3,000 employees) while R&D services in natural/engineering sciences and advertising firms rank fourth and fifth with about 1,230 employees each.[3] Software firms are on average considerably larger than architecture firms and engineering consultants: a software enterprise employs on average 17 persons; architecture firms and engineering consultants a mere 4.4. The two R&D-intensive service industries data processing/databases and research and development represent a considerable potential in Bremen with more than 5,600 employees (Statistical Office Bremen, 2003).

While the private (profit-oriented) knowledge infrastructure of the Bremen region is underdeveloped, the public research and innovation system is well equipped. Bremen possesses good and competitive scientific potentials. The regional research sector is well developed in an inter-regional comparison. Major public R&D actors in Bremen are the University of Bremen, the International University Bremen (IUB), the University of the Arts and the Universities of Applied Science, in both Bremen and Bremerhaven. Altogether there are nearly 35,000 students registered at Bremen's universities. Other national public RTD organizations and a large variety of internationally renowned regional research institutes complement the public research system of Bremen.

Deficits, however, exist in the transfer of research results into regional value added. There are too few viable transfer bridges which transmit the scientific potential into income and jobs for the Bremen and Bremerhaven. A below average start-up rate of knowledge-intensive business service firms is one indication for this deficit. Nevertheless, in recent years the regional government had introduced a number measures for stimulating start-up activities. Besides the business start-up initiative B.E.G.IN, special programs for the promotion of spin-offs from universities and other research institutes were implemented beginning in the late 1990s. The most important programs are the state program for the promotion of start-ups by university graduates (personnel promotion) and the initiative of Bremen University for the promotion of entrepreneurial thinking, firm formation and entrepreneurship (BRIDGE). Also the technology park University of Bremen has to be mentioned in this respect. It was established by the end of the 1980s. A total area of 150 hectares contains: the University of Bremen with 12 faculties, 14 research insti-

3 The advertising industry consists of following subgroups: advertising design, advertising consulting, multi-media applications, design of Internet pages etc., advertisement agencies and so on.

tutes with about 600 employees, the technology and incubation center "BITZ" with about 50 enterprises and 250 employees, and 350 companies with 6,000 employees (Koschatzky, 2004).

5. New Firm Formation Dynamics in the Bremen KIBS Sector

When analyzing start-up activities, we rely on the special preparation of the Mannheim Start-Up Panel (ZEW Gründungspanel West), which covers the very small enterprises without dependent staff rather completely (cf. table 9.2). Only economically active firms are covered. Original start-ups, i.e. the emergence of completely new firms, can be identified from derivative firm formation (e.g. from takeovers and plant set-ups of already existing enterprises and plant set-ups, see also Almus et al., 2002).

Table 9.2: New firm formation in knowledge-intensive services in Bremen 1996-2001

	Economic sector/year	1996	1997	1998	1999	2000	2001
technological services	Telecommunications	0	0	0	0	1	4
	Hardware consultancy	30	1	12	3	4	0
	Software houses	55	24	31	69	76	50
	Data processing services / databases	1	25	9	16	32	7
	Maintenance, repair of office equipment	6	4	5	3	0	0
	Other activities connected with comp.	0	37	29	4	6	52
	Architects and engineering firms	69	99	28	32	25	50
	Technical, physical and chemical surveys/R&D in natural and engineering sciences	0	11	12	16	11	13
	Technological services in total	163	201	127	143	155	176
Non-techn. services	Legal advice, tax and management consultancies, R&D in law, economics and social sciences	74	96	86	102	117	93
	Advertising	34	44	22	17	26	21
	Non-technological consultants in total	108	140	108	119	143	114

Source: ZEW start-up panel.

In the period from 1996 to 2001 the number of start-ups varies for the technology-intensive and knowledge-intensive service firms between 127 and 201. With this start-up activity, Bremen ranks below the West German average in its start-up intensity (= enterprise start-ups per 1,000 of the economically active population). The start-up intensity for both technological services and non-technological services varied between 0.4 to 0.5 for western Germany in the years 1995-2001, while it was between 0.2 and 0.4 for Bremen

(Koch and Stahlecker, 2005). Over the years, pronounced start-up intensities are found in software, other activities associated with data processing, architecture firms and engineering consultants. They coincide with a high stock of firms in these industries. Net-entry (i.e. foundations minus closures) is the greatest wherever a certain 'critical mass' exists. Despite a 'turnover' of firms in these aggregates, positive effects on employment can be assumed. Relatively steady numbers of start-ups are exhibited in technical, physical, and chemical testing and R&D in the fields of natural and engineering sciences. In the non-technical consultancies, there are relatively steady numbers of start-ups – and on a high level – in legal, tax, and business consultancy (NACE 74.1), and R&D in the fields of law, economics, and social sciences (73.2). These industries account on average for approximately two thirds of all start-ups in non-technical consultancies. The advertising industry (NACE 74.4) also shows constant numbers of start-ups, but on a clearly lower level.

6. Empirical Results of the Primary Analysis

In the following sections the institutional background, the regional framework conditions, and the market and technology ties of the KIBS will be investigated more closely (cf. the set of questions formulated in section 2).

6.1 Institutional Background of New Firm Formation in the KIBS Sector

The institutional background of new firm formation and the general start-up intensity give hints about the ability of a regional innovation system to adapt to structural changes and to renew its stock of firms. About 80 percent of the founders taking part in the survey came from the Bremen region. Thus, the spatial tie to the home or previous work location is about as high as established in other studies (e.g. Hayter, 1997). The results indicate that about one third (27 persons) of the 86 founders (distributed among 51 enterprises), who were previously active in the region, were from a university or a non-university research institute; another third (27 persons) came from private companies, half of them had more than 500 employees and half of them with less than 500 employees. About 23 percent (20 persons) of the founders from the region were previously free-lance or self employed. The remaining Bremen-based founders had been students, trainees etc. before setting up their own business. 22 founders, both male and female, (= 17 percent of all founders) previously worked outside the region and, subsequently, set up their business (or participated in a start-up project) in Bremen.

Approximately 32 percent of the entrepreneurs interviewed stated that the idea for the start-up had occurred during employment in an enterprise, three quarters thereof in enterprises located in the State of Bremen. One of the

KIBS entrepreneurs interviewed described the context of setting-up his business as follows:

> *The reason for setting up a new business was the bankruptcy of my former employer. The founding process was characterized by the existence of two to three 'lead clients' which I transferred from my former employer. Those clients played a significant role in the early development phase of the firm. Management experience and strong contacts to clients within the context of my former occupation appeared to be crucial for the acquisition of these clients. Personal contacts and social network, were the key factors for the start-up process. The main reasons for the firm formation in Bremen were my residence and my personal networks here. Anyway, despite the transfer of former clients, the overall customer structure had to be arranged and changed – compared to the former customers. One of the major obstacles during the start-up stage was competitive disadvantages due to the small size of my firm. Many potential customers did not accept the firm as a reliable company due to its small size.*

This statement indicates, what Almus et al. (2001) documented: most of the entrepreneurs start businesses in industries where they already gathered experience and social contacts. Depending on the number and type of customers, the dependency from those firms could be as high as in the former occupation as an employee. For Bremen, relatively few resident companies are in a position to produce knowledge-intensive business service spin-offs. Interesting developments seem to occur in the harbor economy, aeronautics and aerospace, mechanical engineering, and microelectronics. Furthermore, the developments at the university are remarkable. A considerable number of scientists from different departments develop business plans, but also students set up their own firms during or directly after completing their degree.

6.2 Framework Conditions and Structural Obstacles

The regional framework conditions in the sense of an entrepreneurial climate play an important role in the analysis of the structural ties of young firms and their growth conditions. Regional renewal through new firm formation can only be successful if the structural barriers for firm entry are low (e.g. general openness of existing companies to cooperate with start-ups, functioning of technology-transfer and knowledge-transfer) and the framework conditions with regard to the further development of start-ups are favorable. In this regard, the regional level of innovation and technology as well as the regional demand for advanced business services appears to be crucial. On the whole, the framework conditions in Bremen for general economic performance are positively assessed (cf. table 9.3). The KIBS in Bremen above all value the good innovation climate, the presence of research and technology suppliers and the well developed communication infrastructure positively. In contrast, difficulties in the access to venture capital are judged critically. However, this form of financing plays a notable role only for a few of the KIBS. A relatively

high level of discontent can also be determined with regard to the transparency of the public support measures, the availability of qualified staff, and the presence of adequate suppliers.

Table 9.3: Assessment of the general conditions in Bremen (n=55, answers in percentages)

Assessment of.... and quality	bad	medium	good	no statement
Innovation milieu	12.7	29.1	52.7	5.5
R&D supplier	10.9	23.6	52.7	12.7
Technology-development measures and economic development measures	20.0	30.9	45.5	3.6
Access to venture capital	36.4	16.4	3.6	43.6
Availability of qualified labor	29.1	25.5	40.0	5.5
Consultancy supply	18.2	38.2	40.0	3.6
Adequate clients	29.1	29.1	30.9	10.9
Adequate suppliers	18.2	21.8	30.9	29.1
IT-infrastructure	3.6	16.4	63.6	16.4
Transparency of public support measures	36.4	27.3	34.5	1.8

Source: Bremen KIBS survey.

Regarding the obstacles in setting up new businesses, one of the greatest problems was seen in the intransparency of the public support measures, public consulting, and bureaucracy (cf. table 9.4). This points to problems in interacting with the local authorities and the state. With innovation cycles growing ever shorter, it is the small and young firms that are increasingly dependent on research promotion, so that these problems gain in importance for the development of the region. Further obstacles are the lack of a regional market, that is, access to customers, and in a dearth of specifically qualified personnel. On the other hand, only a small need to catch up is perceived in the area of cooperation with various institutions.

Table 9.4: Obstacles affecting the start-up process and the competitiveness of young KIBS (n 55, answers in per cent, multiple answers possible)

Intransparency of public support measures	45.5
No or small regional demand	36.4
Intransparency of public consultancy measures	36.4
Bureaucracy	34.5
Recruiting of qualified labor	32.7
Lack of service firms as cooperation partners	9.1
Lack of cooperation opportunities with R&D institutions	9.1
Lack of information about technology supplier	9.1
Lack of cooperation with manufacturing firms	5.5

Source: Bremen KIBS survey.

Besides the categories mentioned, additional barriers are seen in financing, for instance, in the allocation practice for bank loans. Not only the bank's lack of willingness to tackle risks places young, innovative enterprises at a disadvantage, but also the tax burden for growing young enterprises (for public taxes). In addition, the competition from university institutes, which are doing contract research for companies and which can often offer cheaper rates, is also a point of criticism. Despite this distortion of competition, spin-offs from universities are judged on the whole as having a positive effect the region.

6.3 Regional Demand Conditions for Young KIBS

One important factor of success of young businesses is the access to the regional market. Especially, the so-called technological 'gatekeepers' and 'pull effects' exerted by regional technology firms represent an important component in regional innovation and start-up activities. Although a series of young technology-intensive and knowledge-intensive firms are already looking for global market penetration early in their existence ('born global'), the regional economic structural ties of young enterprises can be seen as attempts to reduce uncertainty and risk. The question to be posed is, thus, how adaptable the business profiles of the start-up companies are to regional sectoral and technology portfolios. One aspect in this context is the location of the most important client. There is a strong orientation towards the City of Bremen. Almost 40 percent of the KIBS stated their most important customer was located here. The structural weakness of the surrounding area is underlined by a correspondingly low customer presence. The most important customer for more than 40 percent of the companies are located elsewhere in Germany and for 10 percent abroad.

Analogous to the geographical distribution of the most important customer, almost 35 percent of the firms stated they made more than 50 percent of their turnover in the State of Bremen. This makes it clear that regional market access or regional customer ties are very significant for the young firms of the sample. Another survey of 547 KIBS has shown (cf. Koch and Strotmann in this volume) that positive growth patterns correlate significantly with an above average share in market and cooperation relationships outside the region. For this reason it must be noted that, at least for the Bremen KIBS, a strong focus on the regional market is likely to be detrimental from the viewpoint of desirable growth assumptions beyond the foundation process. This applies especially to science-orientated and technology-oriented companies.

Almost 40 percent of the KIBS stated that a regional lead customer was of substantial significance for the start-up process. For the majority of the sample firms (60 percent), however, such lead customer played no or only a minor role. An entrepreneur who has set up a KIBS firm (engineering services) can be quoted as:

My experiences and social contacts made in my former occupation were extremely helpful in setting up the company. Although, it took quite a while to get the first contract, I was very confident that I would be successful. To find customers as a new company without knowing anybody is extremely difficult, particularly in the service sector. After a while of market experience with your own company, the negotiations with further customers become completely different.

This example shows that person-based ('ego-centric') networks or social competencies could influence entrepreneurial activities. Within this context, Sternberg (2000) points to the importance of an entrepreneurial social infrastructure as a key element of the regional environment for entrepreneurship.

Further economic structural ties are related to intrasectoral interdependencies, i.e. the demand for complementary knowledge-intensive services from other KIBS. Out of these, non-technical services (as are typically offered by lawyers, tax advisers, accountants, employment agencies, and management consultancies) were usually demanded locally. For specialized technical services (e.g. sector-specific services such as IT consultants, support for software applications, R&D services etc.) the search radius was much larger. The probability of finding a highly specialized company in the region is relatively small (or vice versa: a highly specialized supplier does not necessarily meet regional demand).

6.4 Knowledge-Oriented and Technological Ties

Not only the start-up process of knowledge-intensive service firms but also their continued development and growth are determined by the availability of knowledge. Concerning this matter, knowledge-transfer with scientific and educational institutes as well with other companies is of particular importance. Cooperation with other firms, whether in the form of customers, suppliers, or even competitors, can have decisive effects on the transfer and development of new solutions in the services provided. Using networks to access external, specialized, or current knowledge is, therefore, seen as being a decisive condition for the enduring competitiveness of knowledge-intensive service firms. This holds particularly for small and medium-sized firms since they are only able to rely on internal resources to a limited extent.

Almost two thirds of the KIBS used the possibility of cooperation for technology and knowledge transfer (cf. figure 9.1). The most important partners here include other companies followed by customers and universities. Technology transfer institutions are hardly used at all to access new technologies; instead the exchange takes place via personal contact. Above all, Bremen University plays a primary role in regional external knowledge supply, whereas there is hardly any cooperation with other local research institutions. This underlines the still existing transfer deficiencies in Bremen's innovation system. With its variety and quality, the knowledge infrastructure of the Bre-

men region is well suited as a nucleus for modernization or regeneration of the regional economy. The precondition for this is that regionally generated know-how, for example, from the university, is retained within the region. The high number of start-ups from the university indicates such possibilities. A rather critical estimation about the role of the university in the Bremen innovation system was expressed by one interviewee:

> *There are some deficiencies in Bremen. The university is not yet in a position that supports the technological and economic progress, which Bremen produced recently. I would emphasize, that the university could do more to adjust its scientific profile to the needs of the region. Compared to the 1970s, things certainly improved, but I think much more could be done, for example in biotechnology, environmental technologies, logistics, etc. It would be wise, if politics would have a stronger influence on these things.*

Despite this critical view, the survey reveals that more than half of the firms which maintain cooperation activities for the acquisition of technology work together with the University of Bremen. In contrast, partners from the region play a much smaller role in other types of cooperative relationship which may be due to the dominance of traditional industries in Bremen with a relatively low share of knowledge-intensive sectors and a low R&D intensity.

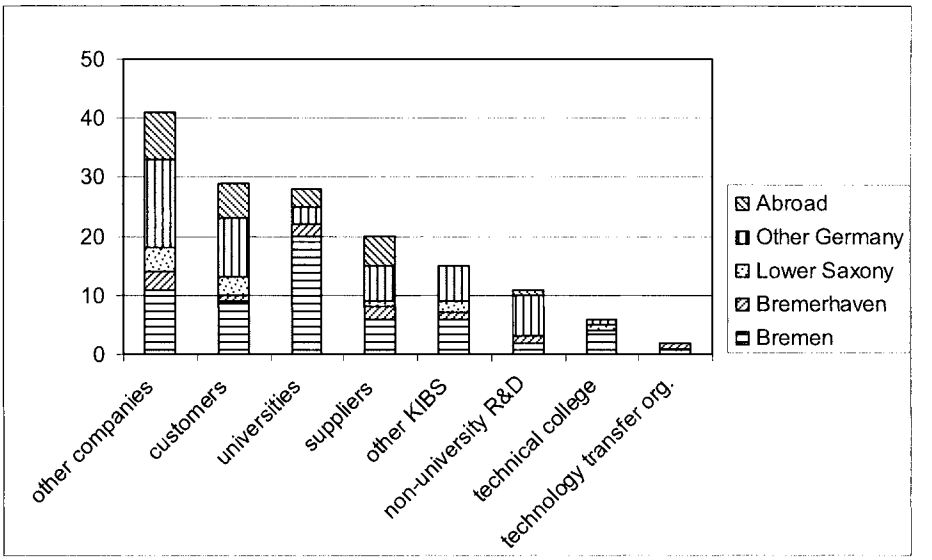

Figure 9.1: Partners in knowledge transfer (n = 55, absolute figures, multiple answers).
Source: Bremen KIBS survey.

The multiple responses in figure 9.1 reflect the fact that the KIBS are not restricted to certain regions in their orientation but cooperate, for example, with other firms both within their own region, within Germany, and/or abroad. One perceived deficiency of Bremen is that too few technological drivers or market openers are based there. Broad fields of application in the

region as well as large regional customers and mentors can – under certain conditions – increase new companies' probability of success. Knowledge-intensive service firms are becoming increasingly reliant on external partners to renew and supplement knowledge due to the ever shorter half-life of knowledge and the increased demands for flexible, specific tailor-made services.

Knowledge exchange usually takes place via informal contacts and is, therefore, not protected by contract (cf. table 9.5). Almost half of the KIBS conducting technology transfer use informal contacts as a cooperation pathway; these play a decisive role for the diffusion of knowledge in innovative fields. Informal contacts are supported by good communications and the possibility of different conversational contexts, which are more likely available in an innovation system the size of Bremen's.

Table 9.5: Cooperation media and intensities in knowledge and technology transfer (only companies conducting technology transfer, n = 35)

Media and intensities	None	Occasionally	Intensely
Informal contacts	14.3	40.0	45.7
Client-relationships	25.7	31.4	42.9
Joint R&D-projects	25.7	42.9	31.4
Cooperation agreements	40.0	37.1	22.9
Contract research	42.9	48.6	8.6
Consultancy	48.6	37.1	14.3
Supplier-relationships	60.0	34.3	5.7

Source: Bremen KIBS survey.

The relationship of KIBS to their customers is usually very intensive; the interaction between service provider and the user of services is strong, due to the high specificity of the services rendered. Because knowledge exchange is a necessary basis of the joint services, the knowledge transfer occurs as a side-effect of the profit-producing activity. In contrast to this, within joint R&D projects, knowledge exchange is an explicit program. As a rule, joint R&D projects are less frequently used but still represent an important means to obtain new knowledge for three quarters of the service providers as do customer relations. Cooperation contracts, contractual research and consultation are less intensively used by the companies but still by more than half of those companies practicing technology transfer. Supplier relationships play the smallest role for the competitiveness of knowledge-intensive service providers. This corresponds to the rather low utilization of external advance services in the shape of intermediate inputs.

More than one third of the KIBS questioned did not cooperate with external partners in order to access new knowledge. This relatively high number of

non-cooperating firms reveals that, in spite of the informal contacts in the region being assessed as being comparatively good, the existing capacity for innovation is not fully utilized. The question has to be raised, whether certain companies do not need new technologies or new knowledge, or whether this need has just not been identified (latent need).

7. Summary and Conclusions for Innovation Policy

Bearing in mind the research questions formulated in section 2, the results of the survey can be summarized as follows:

Start-up origin: the founders of young KIBS in Bremen have strong regional ties. Almost 80 percent come from the region. Universities were the most important incubator organization. Of all founders, 25.9 percent or 27.9 percent of all founders from Bremen were employed there beforehand or studied there. This clarifies that the public sector, caused by its spin-off promotion programs, has a strong influence on the start-up activity of KIBS, especially at the universities, and, thus, on their role within the regional innovation system. In contrast to this, non-university research institutions hardly play any role as incubators (3.7 percent) 24 percent of the founders were freelancers before setting up their companies or self-employed. Approximately 32 percent were employed in companies, of which SMEs made up the larger share. The structure of Bremen's innovation system is, thus, reflected in the foundation origins of the KIBS, in which research and scientific activity play at least as large a role in company start-ups as a previous activity in business.

General framework conditions: the general regional conditions for company start-ups are on average estimated as good. Bremen's strengths are its good communication infrastructure, the research offered as well as the general climate for innovation. The supply orientation of the innovation system is reflected again here. Poorer ratings were assigned to the availability of qualified labor, the existence of customers, access to equity capital as well as the intransparency of the promotion offered. Whereas the last two aspects often receive poor ratings in surveys, the criticism of the regional market with regard to customers and workforce is again an expression of a regional economic structure not completely suited to young KIBS.

Regional demand ties: the analyses showed that Bremen's KIBS are evolving more and more into an independent demand aggregate for a whole series of suppliers; in the process of doing so, they themselves are demanding knowledge-intensive services in many cases. Market entry strategies, which lower risk and uncertainty, were visible through the involvement and linked in regionally anchored value added structures (significance of spatially close social networks). 'Technological anchors' played an important role in the start-up process especially in information and communications as well as in the aerospace industry. A presence on national/foreign markets takes place paral-

lel to the market penetration geared to the local area. Half of the KIBS stated that their most important customer is located elsewhere in Germany or abroad. In contrast, exporting services abroad still seems to be underdeveloped which is, however, also typical for young businesses. On the other hand, closed network configurations around the main industries in Bremen – as an obstacle to accessing advance services and supplier chains – do not play a relevant role.

Knowledge-oriented and technological ties: knowledge transfer takes places predominantly in the personal exchange of informal contacts ('point-to-point'); institutionalized technology transfer structures are less significant in comparison. In conjunction with supplier relations, customer contacts and relationships with other companies (who may also be competitors) play the most important role in knowledge transfer. The majority of these partners are located outside Bremen (elsewhere in Germany and abroad); for about one fifth of the KIBS, the partners in question are based in Bremen and Bremerhaven. Non-university research institutions in Bremen and Bremerhaven have hardly been used as knowledge or technology supplier thus far. In spite of the significance of access to external knowledge for knowledge-intensive services, a large share of the companies is not aware of the exchange possibilities.

The analyses showed that a considerable part of the KIBS interviewed in Bremen originate from public research institutes, especially universities, and have strong ties to their own region. By virtue of these origins and ties, they represent an important bridge between the research sector and the market, and they contribute to economic modernization in an innovation system, which is still strongly dominated by the public sector. On the one hand, this bridging function is an opportunity for Bremen's innovation system since the research and the generation of new knowledge can be boosted by this in the private sector. On the other hand, there is the risk of too great of a dependence on regional demand conditions and technological path dependencies stemming from the proximity to important customers and other regional players. Companies, including KIBS, are particularly innovative if they are characterized by a variety of external ties. Intraregional and interregional integration are important factors for stimulating growth. For this reason, one further target of Bremen's innovation policy should be the promotion of start-ups in the service sector and the creation of incentives for these companies to network both within and beyond the region. The results of this study have shown that the government of Bremen can focus on start-ups from the public research sector, where it has a strong governance impact. Thus, it can explicitly and directly contribute to economic modernization and the development of a competitive regional innovation system.

References

Almus, M., Egeln, J. and Engel, D., 2001, Determinanten regionaler Unterschiede in der Gründungshäufigkeit wissensintensiver Dienstleister, *Jahrbuch für Regionalwissenschaft*, 21, 25-51.

Almus, M., Engel, D., Prantl, S. 2002, Die Mannheimer Gründungspanels des Zentrums für Europäische Wirtschaftsforschung GmbH (ZEW). In *Das Gründungsgeschehen in Deutschland. Darstellung und Vergleich der Datenquellen.* Fritsch, M., Grotz, R. (Hrsg.), Heidelberg: Physica-Verlag, 79-102.

Antonelli, C., 1999, The evolution of the industrial organisation of the production of knowledge, *Cambridge Journal of Economics*, 23, 243-260.

Bergmann, H., 2004, *Gründungsaktivitäten im regionalen Kontext. Gründer, Gründungseinstellungen und Rahmenbedingungen in zehn deutschen Regionen,* Köln: Selbstverlag im Wirtschafts- und Sozialgeographischen Institut der Universität zu Köln.

Bilderbeek, R. and den Hertog, P., 1998, Technology-based knowledge-intensive business services in the Netherlands: their significance as a driving force behind knowledge-driven innovation, DIW *Vierteljahreshefte zur Wirtschaftsforschung*, 126-138.

Birch, D.L.,1987, *Job Creation in America. How our smallest companies put the most people to work*, New York: Free Press.

BMBF, 2004, (Federal Ministry for Education and Research). *Bundesbericht Forschung 2004*, Bonn: BMBF.

Cooke, P., 2004, Introduction: Regional innovation systems – an evolutionary approach. In Regional Innovation Systems. The Role of Governance in a Globalized World. 2nd edition Cooke, P., Heidenreich, M. and Braczyk, H.-J. (eds), London, New York: Routledge, 1-18.

Czarnitzki, D. and Spielkamp, A., 2003, Business services in Germany: bridges for innovation. *The Service Industries Journal*, 23, 1-31.

Engel, D. and Steil, F., 1999, Dienstleistungsneugründungen in Baden-Württemberg (= *Arbeitsbericht der Akademie für Technikfolgenabschätzung in Baden-Württemberg* No.139). Stuttgart: Akademie für Technikfolgenabschätzung.

Free Hanseatic City of Bremen, 2004, *InnoVision 2010, Bremen's Innovation Programme. Bremen*, Bremen: Senator for Economic Affairs and Ports.

Fritsch, M., Brixy, U., Niese, M. and Otto, A., 2004, Gründungen in Städten, *Zeitschrift für Wirtschaftsgeographie*, 48, 182-195.

Fritsch, M. and Grotz, R., 2002, (eds.) *Das Gründungsgeschehen in Deutschland. Darstellung und Vergleich der Datenquellen.* Heidelberg: Physica-Verlag.

Fritsch, M. and Niese, M. (eds.), 2004, *Gründungsprozess und Gründungserfolg. Interdisziplinäre Beiträge zum Entrepreneurship Research.* Heidelberg: Physica-Verlag.

Fritsch, M. and Mueller, P., 2004, Effects of New Business Formation on Regional Development over Time. *Regional Studies*, 38, 961-975.

Geroski, P.A., 1995, What do we know about entry?, *International Journal of Industrial Organization*, 13, 421-440.

Hauknes, J., 1998, *Services in Innoavtion – Innovation in Services.* STEP group, SI4S Final Report, Oslo.

Hamm, R. and Wienert, H., 1990, *Strukturelle Anpassung altindustrieller Regionen im internationalen Vergleich*, Schriftenreihe des Rheinischisch-Westfälischen Instituts für Wirtschaftsforschung Essen, Berlin: Duncker u. Humblot.

Hayter, R., 1997, *The Dynamics of Industrial Location: The Factory, the Firm and the Production System.* Chicester, New York: Wiley.

Healey, M.J. and Rawlinson, M.B., 1993, Interviewing business owners and managers: a review of methods and techniques. *Geoforum*, 24, 339-355.

Hipp, C., 2000, *Innovationsprozesse im Dienstleistungssektor. Eine theoretisch und empirisch basierte Innovationstypologie*, Heidelberg: Physica-Verlag.

Illeris, S., 1996, *The Service Economy. A Geographical Approach.* Chichester: John Wiley & Sons.

Kerst, C., 1997, *Unternehmensbezogene Dienstleistungen als Elemente einer innovativen Regionalökonomie.* Stuttgart: Akademie für Technikfolgenabschätzung in Baden-Württemberg.

Klodt, H., Maurer, R. and Schimmelpfennig, A., 1997, *Tertiärisierung in der deutschen Wirtschaft*, Kiel: Kieler Studien, 283.

Koch, A. and Stahlecker, T., 2005, Regional innovation systems and the foundation of knowledge intensive business services. *European Planning Studies* (forthcoming).

Koch, A. and Stahlecker, T., 2004, *Social networks, relational and spatial proximity. Founding processes and early development of KIBS start-ups.* Paper prepared for the 13th Nordic Conference on Small Business Research. Tromsø, Norway, June 10-12.

Koschatzky, K., Jappe, A., Hemer, J., Wolf, B., 2004, *Technologietrends und regionale Entwicklungspotenziale in den bremischen Innovationsfeldern.* Karlsruhe: Fraunhofer ISI.

Koschatzky, K., 2004, *ERAWATCH prototyping Phase, ESTO Study No.2: Analysis on the regional dimensions of the 3 % action plan. Regional report Bremen.* Seville: IPTC.

Kujath, H.J., 1998, Zwischen Marginalisierung und Aufstieg. Regionen unter dem Einfluß technologischen Wandels und industrieller Restrukturierung. In *Strategien der regionalen Stabilisierung. Wirtschaftliche und politische Antworten auf die Internationalisierung des Raumes*, Kujath, H.J. (ed.), Berlin: Ed. Sigma, 83-107.

Lo, V., 2003, *Wissensbasierte Netzwerke im Finanzsektor. Das Beispiel des Mergers & Acquisitions-Geschäfts.* Wiesbaden: Deutscher Universitäts-Verlag.

Lundvall, B.-A. and Johnson, B., 1994, The learning economy, *Journal of Industry Studies*, 1, 23-42.

Malecki, E.J., 1997, Entrepreneurs, networks, and economic development: A review of recent research. *Advances in Entrepreneurship, Firm Emergence and Growth*, 3, 57-118.

Malecki, E.J., 1994, Entrepreneurship in regional and local development. *International Regional Science Reviews*, 6, 119-153.

Malmberg, A. and Maskell, P., 1997, Toward an explanation of regional specialization and industry agglomeration. *European Planning Studies*, 5, 25-41.

Meusburger, P., 2000, The spatial concentration of knowledge. Some theoretical considerations. *Erdkunde*, 54, 352-364.

Meyer-Krahmer F. and Lay, G., 2001, Der Stellenwert innovativer Dienstleistungen in der Modernisierungsdebatte. *WSI-Mitteilungen*, No. 6, 396-400.

Miles I., Kastrinos N., Flanagan K., Bilderbeek R., den Hertog P., Huntink W. and Bouman, M., 1995, *Knowledge-intensive business services. Users, carriers and sources of innovation.* EIMS Publication No. 15 (European Innovation Monitoring System – European Commission DG XII). Brussels: European Commission.

Miles, I., 2003, Services and the Knowledge-Based Economy. In *Service Innovation, Organizational Responses to Technological Opportunities & Market Imperatives*, Tidd, J., Hull, F.M. (eds)., London:Imperial College Press, 81-112.

Miles, I., 2000, Services Innovation: Coming of age in the knowledge-based economy. *International Journal of Innovation Management*, 4, 371-389.

Muller, E., 2001, *Innovation interaction between knowledge-intensive business services and small and medium-sized enterprises – an analysis in terms of evolution, knowledge and territories.* Heidelberg:Physica-Verlag.

Muller, E. and Zenker, A., 2001, Business services as actors of knowledge transformation: the role of KIBS in regional and national innovation systems. *Research Policy*, 30, 1501-1516.

Nerlinger, E., 1998, *Standorte und Entwicklung junger innovativer Unternehmen. Empirische Ergebnisse für West-Deutschland.* ZEW-Wirtschaftsanalysen, Bd. 27. Baden-Baden:Nomos.

Niese, M., 2003, *Ursachen von Betriebsschließungen. Eine mikroökonomische Analyse von Probezeiten und Todesschatten im verarbeitenden Gewerbe.* Münster:LIT Verlag.

Reynolds, P., Storey, D. J. and Westhead, P., 1994, Cross-national comparison of the variation in new firm formation rates. *Regional Studies*, 28, 443-456.

Santarelli, E. and Piergiovanni, R., 1995, The determinants of firm start-up and entry in Italian producer services. *Small Business Economics*, 7, 221-230.

Schamp, E.W., 2000, *Vernetzte Produktion. Industriegeographie aus institutioneller Perspektive.* Darmstadt:Wissenschaftliche Buchgesellschaft.

Staber, U., 1996, The social embeddedness of industrial districts networks. In *Business Networks. Prospects for regional development*, Staber, U., Schaefer, N., Sharma, B. (eds.), Berlin, New York: de Gruyter, 148-174.

Statistical Office Bremen, 2003, *Auswertungen der Gewerbeanzeigen wissensintensiver Dienstleistungen im Land Bremen*, Bremen.

Stehr, N., 1994, *Knowledge societies.* London: Sage.

Sternberg, R., 2000, Gründungsforschung – Relevanz des Raumes und Aufgaben der Wirtschaftsgeographie. *Geographische Zeitschrift*, 88, 199-219.

Strambach, S., 2001, Innovation processes and the role of knowledge-intensive business services (KIBS). In *Innovation Networks – Concepts and Challenges in the European Perspective. Technology, Innovation and Policy*, Koschatzky, K., Kulicke, M. and Zenker, A. (eds), Heidelberg:Physica-Verlag, 53-68.

Tether, B., 2003, The Sources and Aims of Innovation in Services: Variety between and within Sectors. *Economics of Innovation and New Technology*, 12, 481-505.

Vaessen, P. and Wever, E., 1993, Spatial responsiveness of small firms. *Tijdschrift voor Economische en Sociale Geografie*, 84, 119-131.

Wood, P., 2002, Knowledge-intensive Services and Urban Innovativeness. *Urban Studies*, 39, 993-1002.

10 DETERMINANTS OF INNOVATIVE ACTIVITY IN NEWLY FOUNDED KNOWLEDGE INTENSIVE BUSINESS SERVICE FIRMS*

Andreas Koch and Harald Strotmann

1. Introduction

The ability to innovate is an essential precondition for competitiveness in the knowledge economy both at the level of a single firm as well as at regional levels. Particularly, in sectors with a high rate of technological progress and where knowledge plays a major role, firms can achieve advantages by developing innovative products and services. Previous research has shown that small firms make a large contribution to innovation in developed economies and that innovation is an important means of entry for new firms (Acs and Audretsch, 1990).

During the last few decades, there have been fundamental changes and enhancements in the understanding of innovation processes. Since the advent of evolutionary concepts in economics, innovation is no longer conceived as a unidirectional and linear process starting with inputs from basic research and resulting in outputs of new technical products. Rather, innovation is viewed as an interactive process involving many different actors and characterized by large uncertainties which have to be overcome by different means, for instance cooperation, networking and spatial proximity (Dosi, 1988, Malerba and Torrisi, 1992; Nelson and Winter, 1982). In this context, researchers have emphasized the role of users and clients (Lundvall, 1988) as well as the role of systemic elements (e.g. Moulaert and Sekia, 2003).

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Despite of the growing awareness that innovation is not confined to technical processes and products, most contemporary research on the preconditions and consequences of innovative activity focuses on the manufacturing sector (for recent empirical studies see, for example, Becker and Dietz, 2004; Huergo and Jaumandreu, 2004; Lynskey, 2004; Rogers, 2004). Only recently have researchers explicitly accounted for the importance of innovative activities in the service sector (e.g. Drejer, 2004; Gallouj and Weinstein, 1997; Sirilli and Evangelista, 1998; Sundbo and Gallouj, 1998; Tether, 2003).

Considering the increasing importance of service activities in modern economies, this existing bias in innovation studies towards the manufacturing sector is surprising. It often results from a lack of suitable firm micro data. Today, the highly "industrialized" nations of the world are all characterized by an outstanding economic significance of the service sector. The most noticeable phenomenon within this process of structural change is perhaps the rapidly growing importance of the so-called Knowledge Intensive Business Service firms (KIBS). In Germany, for example, more than 14 percent of all new firms in 2002 have been founded in this sector (ZEW, 2004).[1] More and more KIBS are believed not to simply perform innovative activity in dependence on the demand of the manufacturing sector, but to be "knowledge bridges" or "bridges of innovation" between manufacturing, science, and clients (Czarnitzki and Spielkamp, 2003).

However, little is known about what determines innovative activity in the sector of knowledge intensive business services. This might be partially contributed to the difficulties in measuring innovative activities in a sector where patenting is unusual and formal R&D is the exception. Existing empirical studies on firm innovation in the service sector and the KIBS sector are mostly based on case study evidence, the analyses of small samples or highly aggregated sectoral or regional data. This study supplements this literature by examining the determinants of firm innovative activity in the KIBS sector using firm micro data, thereby focusing on newly-founded KIBS. On the basis of the KIBS Foundation Survey 2003, a new micro dataset of 547 start-up firms in three German agglomeration regions[2], we are able to analyze the role of possible determinants of innovation within a multivariate framework.

Section 2 gives a brief description of the central characteristics of the firms in the KIBS sector and the general nature of their innovative activities. Based on this description, we hypothesize amongst others that managerial characteristics and external linkages of a firm are crucial determinants of their innova-

1 However, the high foundation rates are simultaneously accompanied by above-average failure rates (Brixy and Grotz, 2004).

2 The KIBS Foundation Survey 2003 is the outcome of a project funded by the German Research Foundation (Grant No. RO 534/6), which has been carried out jointly by the Institute for Applied Economic Research (IAW) in Tübingen and the Fraunhofer Institute for Systems and Innovation Research (ISI) in Karlsruhe. We are indebted to our colleagues Knut Koschatzky and Thomas Stahlecker for the fruitful cooperation.

tive activity (section 3). Dataset and methodology are described in section 4, whereas section 5 outlines the main empirical results from ordered logit and multinomial logit regressions. Section 6 concludes.

2. Characteristics of the KIBS Sector

The central characteristics of firms in the KIBS sector are knowledge intensity and the orientation of their services to other firms or organizations (Haas and Lindemann, 2003).[3] KIBS provide non-material, intangible and highly customized services like software development, engineering services or business consultancy. On one hand, they act as external knowledge sources for their client firms, and, on the other , they are increasingly becoming independent innovation creators (Czarnitzki and Spielkamp, 2003; Gallouj and Weinstein, 1997). The provision of knowledge intensive business services requires specialized knowledge and cumulative learning processes, which can only be realized by intense interaction between service suppliers and clients (Johannisson, 1998; Strambach, 2002). As KIBS mostly provide highly application-oriented services, implicit knowledge plays an important role. For the acquisition of this type of knowledge, cooperation, trust, communication and face-to face contacts are very important (Howells, 2002). Thus, knowledge intensive business service firms locate mainly in close spatial proximity to their customers (Illeris, 1994).[4] As in most branches of the service sector, scale economies play a minor role in the KIBS sector and thus, most firms are small or medium sized and on the average smaller than in manufacturing (Audretsch et al., 1999).

Generally, three motives for the foundation of new firms in the KIBS sector can be identified: (1) Outsourcing processes in existing firms, (2) changes in the organization of innovation processes in the manufacturing sector, and (3) the creation of new user needs by independent innovation activities in the

3 The definition of the KIBS sector in the Standard Industry Classification is not consistent across different studies. However, the mainstream of existing research includes the following sectors: Computer and Related Activities (72), Research and Development (73) as well as the sub-sectors of Legal, Accounting, Book-keeping and Auditing Activities, Tax Consultancy, Market Research etc. (74.1), Architectural and Engineering Activities and related Technical Consultancy (74.2), Technical Testing and Analysis (74.3) and most parts of the Advertising Sector (74.4). Furthermore, it is usually differentiated between Technical KIBS (72, 73.1, 74.2, 74.3) and Professional KIBS (73.2, 74.1, 74.4). For an overview of this discussion see Koch and Stahlecker (2005). The knowledge intensity is measured by input factors like the qualification structure of the employees or the R&D expenditures, or by output factors like innovations or patents (Haas and Lindemann, 2003).

4 Indeed, at least in Germany, most firms and firm foundations in the KIBS-sector concentrate in the major urban agglomerations (Brixy and Grotz, 2004), where also important potential clients are located. However, the role of proximity may well vary not only from firm to firm, but also between different sub-sectors of the KIBS-sector (Czarnitzki and Spielkamp, 2003).

KIBS sector (Strambach, 2002; Koch and Stahlecker, 2005). Regardless of the motivation for a foundation, intense and close interaction with clients is a distinctive feature of KIBS, particularly in the early stages of a firm's development when services are least standardized. Thus, it is necessary to maintain a frequent exchange of information, communication, and trust in order to anticipate (or even to create) user needs and to meet the specific demands. For the purpose of performing innovative activity in the KIBS sector, it is crucial to gain access to relevant information and, subsequently, to adequate communication channels and networks.

3. Determinants of Innovative Activity in the KIBS Sector

In the following section, we will argue that the probability of a newly founded firm in the KIBS sector to innovate is essentially determined by its *internal (idiosyncratic) technological and organizational capabilities and by its external linkages* (for similar concepts see e.g. Lynskey, 2004; Malerba/Torrisi, 1992).[5] A series of uncertainties determines both the foundation of a new firm and the development of innovative, new-to-the-market products or services. It is, therefore, necessary to have access to information and knowledge in order to manage and reduce these uncertainties. The existing stock of experience and knowledge as well as the capacity to interact and cooperate may reduce uncertainties.

3.1 Internal Capabilities in New Firms: Managerial Characteristics

New products require new competencies or at least a new combination of competencies. In new firms, particularly in independent and originary start-ups – the internal, idiosyncratic capabilities are strongly linked to the founder (or founders). By adding his or her experiences, motivations, and networks, he or she is the creative mind and the central agent for strategic decisions and innovative activities (Johannisson, 1998). The small size of newly founded independent firms intensifies the important role of the founder in the early stages of a firm's development. Thus, the technological and organizational capabilities of the founder of a new firm might be considered as important elements that determine the innovative activity of the firm (Lynskey, 2004).[6]

5 Similarly, Cohen (1995, 203) identifies two sorts of capabilities analyzed in existing empirical studies: Whereas *organizational or procedural capabilities* condition the R&D productivity of firms, *substantive technological or related expertise* leads them to pursue different kind of innovative activity. It has to be noted that the results of Malerba and Torrisi (1992) are based on a sample of only 51 software companies and thus have to be handled with some caution.

6 This concept follows evolutionary thinking and is normally applied to established firms, as is also pointed out by Dosi (1988, 225): "What the firm can hope to do technologically in the future is heavily constrained by what it has been capable of doing in the past." Surely, it could

Malerba and Torrisi's (1992, 50) statement that firms "accumulate idiosyncratic capabilities over time" by learning has to be supplemented by the conclusion that capabilities are also "imported" into a new firm (Shane, 2000). These "imported" capabilities, like concrete and applied prior knowledge about services, products or technologies as well as experience-based organizational and managerial competencies may not only influence the type and sector of the start-up but also the direction and intensity of innovative activity.

The majority of economic activities in the KIBS sector show characteristics of high customization of the services towards the clients, because specialized, uncodified (tacit) knowledge is important to start a new firm and perform innovations. Formalized knowledge (university, patenting, etc.), on the other hand, is of minor importance in newly founded KIBS firms, mainly due to the dynamic development, the customer orientation and the short product life cycles of services.[7] We might expect, accordingly, a higher probability to innovate when the founders dispose of adequate specialized and applied knowledge and personal networks, routines, and experiences. A founder, for example, who transfers specialized knowledge or even ready-to-market services from another private firm (employee start-up) may be more likely to develop innovative services (Klepper, 2001). It is very likely that these founders had the opportunity to learn how to perform innovatively in a special field due to their former occupations. They might also be more likely to dispose of a set of relevant routines and experiences. Furthermore, they are supposed to be integrated in relevant networks (see section 3.2). Koch and Stahlecker (2004) figure out that it is most usual that the founders of newly founded firms in the KIBS sector apply their previous work experience in the same field of activity. Hence, the first hypothesis to be tested within the following empirical analyses is:

> *H1:* The professional capabilities of the founder(s) (e.g. work experience, access to ideas) influence the innovative activities of start-ups in the KIBS sector. Applied technological and organizational experiences enhance the probability to innovate.

Due to informational and subsequently arising technological and organizational advantages, we might expect that teams of founders have an advantage compared to start-ups by single founders. The stock of experiences and

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be argued that new firms are frequently rather controlled by e.g. venture capitalists or respective creditors. This might be true for capital-intensive start-ups; however, as most firms in the service sector are not capital intensive, venture capital is not a usual way of financing a new firm, at least in most sub-sectors.

7 Several studies (e.g. Sirili and Evangelista, 1998; Sundbo and Gallouj, 1998) confirm that formal protecting like patenting is of minor importance in the service sector. Without doubt, differences between sub-sectors can be expected. For example, for a service firm advising high-tech oriented manufacturing firms it is more important to dispose of profound technical and formalized knowledge than for a business consultant whose service is primarily based on the provision of experiences and network contacts.

knowledge and the resulting chances to develop innovative ideas and products should be positively (albeit not linearly) correlated with the number of individuals in the founding team. Moreover, the differences in the backgrounds of the members of the founding team may play an important role in determining the development of innovative activities in the new firms. We anticipate that founding teams combining competencies from different fields have advantages in this respect. Therefore, our second hypothesis concerns the role of founding teams:

H2: KIBS start-ups founded by a team are more probable to innovate, especially when the founders have different professional backgrounds.

There may be also factors limiting the influence of the founders capabilities to perform innovative activities in the KIBS sector. As Lynskey (2004, 173) states, it is not only crucial for a new firm to internally apply a stock of capacities for innovative activity, but also "to be aware of and associate with [external] sources of knowledge, together with its capacity to assimilate and apply such knowledge to R&D". An orientation that is too strong in regards to internal competencies, knowledge and experiences may cause lock-in effects.[8] Thus, a balance between the concentration on internal capabilities and the openness towards the environment is supposed to be most conducive to innovation (Deephouse, 1999; Oerlemans and Meeus, 2005). As internal capabilities are a necessary, but not a sufficient precondition for effectively performing innovation, firms "cannot rely only on internal capabilities; rather they establish formal and informal networks which allow them to obtain knowledge and expertise" (Malerba and Torrisi, 1992, 50).[9] At the same time, the "internal capabilities affect the extent and type of external network channels used by firms" (ibid., 51).

3.2 External Linkages, Interaction and Networking

As aforementioned, interaction with users plays an important role for innovation activities in the KIBS sector. We suggest three features of external linkages that might be of particular relevance: (1) the generic networks which influence the access and exchange of information as well as knowledge and thus impact on innovative activity, (2) the specific networks in the KIBS sector regarding the interaction and cooperation with clients and (3) spatial proximity which influences the exchange of knowledge and information.

The access to information and knowledge as well as the process of knowledge generation are pivotal elements of innovative activity (e.g. Arvanitis, 2002; Becker and Dietz, 2004; Rogers, 2004; for a recent overview see Pit-

8 These thoughts are also based upon Nelson and Winter's (1982) reasoning about entrepreneurial vs. routinized regimes in innovative activity.

9 This consideration is based on Granovetter's (1973) theory of weak and strong ties, stating that for an efficient flow of new information and knowledge, particularly weak ties are important.

taway et al., 2004) and firm foundation (e.g. Johannisson, 1998; Elfring and Hulsink, 2003, for an overview see Witt, 2004). The degree of absorption of extramural knowledge and the amount of knowledge which is available to the firm are supposedly of particular relevance. Know-how from both users and competitors is believed to be of high significance for R&D activities (Arvanitis, 2002). Therefore, we may conclude that it is essential to possess adequate channels in order to attain access to information and knowledge. Whereas, firms may be able to reduce costs, risks and uncertainties of the innovation process through cooperation, information sharing, acquisition of external knowledge, opening up new markets and so on. (Pittaway et al., 2004). Thus, our third hypothesis is:

H3: The access to information and knowledge is positively correlated with innovative activity in newly founded KIBS.

These processes of networking, however, are a somewhat ambiguous phenomenon, and research results are rather contradictory (Pittaway et al., 2004).[10] Love and Roper (2001), in a comparative study on Irish, British and German firms, find no significant relation between external linkages and innovation intensity. In contrast, Becker and Dietz (2004) observe that cooperation significantly enhances the innovative output of firms in a study of 2,200 German manufacturing firms; they also emphasize that a mix of heterogeneous actors in the innovative process raises the probability of product innovations. Rogers (2004) concludes, in a study of 4,500 Australian firms, that networking is particularly important in very small firms, whereas it does not matter in bigger firms.

Networks might be of particular importance in the KIBS sector because most of the current knowledge about products and services is uncodified and thus embodied in individuals. Innovations are frequently the outcome of interactive processes between user and producer in the KIBS sector ("ad-hoc innovation", as Tether, 2003, names it). This type of knowledge acquired via learning-by-using knowledge may be regarded as a central element of innovative activity (Lundvall, 1988). Due to the significance of uncodified knowledge, we expect that the relevance of access to applied knowledge and information exceeds the relevance of formalized knowledge from research institutions (this is analogously the case for the internal capabilities, cp. section 3.1):[11]

H4: Cooperation with partners (e.g. universities, firms) and integration into the customers' innovation processes enhances the probability of innovation in newly founded KIBS firms.

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10 The causes for that phenomenon may be manifold, but they can be expected to be predominantly of methodological nature as the samples and the methods and definitions of networking are defined differently throughout the studies.

11 For the manufacturing sector, however, Lynskey (2004) finds a high significance for joint projects with universities and the probability of a firm to innovate.

Last but not least, spatial proximity is often regarded as a factor influencing innovative activity because cooperation, knowledge exchange and networking frequently occur on informal levels and are based on reciprocity and trust (Tödtling and Kaufmann, 2001). Spatial proximity between different actors is believed to enhance frequent (face-to-face) contacts, a common understanding or culture and, thus, networking. Illeris (1994) provides case-study evidence that geographical proximity fosters different levels of cooperation in each sub-sector of the KIBS sector. In a comparative study of three European regions, Sternberg (1999) states that small firms have a higher probability to maintain intraregional linkages such as cooperation for innovation.

Contrarily, Freel (2000, 262) observes that innovators are more likely to have extra-regional linkages and collaborative arrangements: "innovators are marked not only by the frequency but also by the geographic reach of external linkages". The truth, though, may lie in the middle. A balanced mixture of intra-regional and extra-regional linkages could be important to perform innovative activity (Oerlemans and Meeus, 2005), resulting in the fifth hypothesis:[12]

H5: Spatial distance between actors matters for the probability to innovate. Particularly a balanced mixture of intra-regional and extra-regional linkages is conducive to innovative activity in the KIBS-sector.

3.3 Firm and Industry Characteristics

The previous sections discussed determinants of a firm's innovative activities in the KIBS sector, which result directly from the special characteristics of this sector and the properties of newly founded firms. Neither the impact of managerial characteristics nor external linkages, interaction, and networking have so far been tested empirically for the KIBS sector based on firm micro data. We conducted this for the first time and, therefore, put special emphasis on these determinants. However, it is well known from existing studies of innovative activities on a firm-level for other sectors, that firm-specific and industry-specific factors might also partly explain firm innovation. Even though they are not in the center of our analysis, we will briefly outline them below (for a detailed view and discussion see e.g. Cohen, 1995).

There is a large strand of literature discussing whether there is a link between firm size, firm age, and firm innovation. With respect to firm size, research results are somewhat ambiguous so far. Since the seminal contributions of Josef Schumpeter (1942), various arguments and empirical studies were presented to discuss the question whether large firms (Schumpeter's

12 Elsewhere, Koch and Strotmann (2005) show that a balance between regional and extra-regional linkages is most conducive to the post-entry performance of start-ups in the KIBS-sector.

originary view) or small firms have advantages in creating innovative products or services. Nelson and Winter (1982) argue that it might depend on the type of industry whether small or large firms tend to have an innovative advantage and distinguish two types of technological regimes, the 'routinized regime' and the 'entrepreneurial regime'. Though there is no ample concordance in the research results with respect to R&D input, the probability of a firm conducting R&D increases with its size, whereas smaller firms tend to account for a disproportionately large share of innovations (output) relative to their size. Thus, R&D productivity tends to decline with size (Cohen, 1995, 184-191).[13]

In a recent paper, Huergo and Jaumandreu (2004) examine the effects of firm age on the probability to innovate with a dataset of 2,300 Spanish firms. While with respect to firm size the data confirm that smaller firms are less innovative than their bigger counterparts, they find a negative non-linear relationship between innovation and firm age: innovative output is generally higher in younger firms than in older ones, however, it is lowest in the middle-aged firms (18-20 years) and then rises again for firms with an age over 25 years. Nevertheless, the impact of firm age on innovation activities is still an ambiguously discussed subject. It remains vague whether organizations loose their adaptability to their environment with an increasing age or whether organizational aging increases innovativeness due to learning processes (Shane and Katila, 2003).

Though we restrict our analysis to the KIBS sector, we still have to consider that this sector is very heterogeneous. Sectoral characteristics as e.g. market structure, expected demand or the degree of price and quality competition may influence the innovation behavior of the firms (see e.g. Arvanitis, 2002; or Huergo and Jaumandreu, 2004).

4. Data, Economic Model and Measurement Issues

4.1 Data

Section 3 showed that, from a theoretical point of view, different factors may explain a firm's capability to innovate. With respect to the typical characteristics of the KIBS sector, we expect that the founder, his educational and professional background, and his ability to draw back on external knowledge by interacting with universities, clients or suppliers are particularly important.

13 This is also in line with Nelson and Winter's (1982) reasoning about entrepreneurial and routinized regimes. Cohen and Levinthal (1989), in an empirical study of 1,719 firms, point out that a firm's investments in R&D affect not only directly the output of innovative products or processes, but also "the capacity to assimilate and exploit new knowledge" (absorptive capacity).

Due to the lack of suitable data, empirical micro data studies analyzing the role of access to knowledge, networking, and spatial proximity for innovative activities of KIBS are still missing. The aim of this study is to fill this gap by creating a new firm micro dataset. In autumn 2003, we conducted a telephone survey with founders of start-ups in the KIBS sector – the *KIBS Foundation Survey 2003* – in three German agglomeration regions (Bremen, Munich, Stuttgart).[14]

The KIBS sector is defined according to the mainstream of publications in this research area (for an overview and discussion of different definitions see Koch and Stahlecker, 2005). It includes firms classified under the NACE-Codes 72, 73 and 741-744[15] (see section 2). Furthermore, we restrict on the population of firms founded between 1996 and 2003 and focus the analysis on genuine foundations listed in the trade registers. Thus, subsidiaries, branch offices, firms arising from mergers and acquisitions, and firm reformations were excluded from our survey.

As a consequence of these definitions, the population size in our three regions is 7,714 firms. We then drew a random sample of 2,108 firms, stratified on the 3-digit sectoral level[16] and interviewed the founders of these firms. In cases where there were more than one founder, we interviewed only one of them. In total, we successfully conducted 547 interviews resulting in a rather satisfactory rate of return of 26 percent.

The interviews were based on a standardized questionnaire, which covered a large variety of detailed questions concerning individual attributes of the founder (e.g. context of business idea, former occupation and location of workplace, skills, etc.), start-up characteristics of the firm and its development over time.

Due to this new micro dataset, we are able to analyze a variety of possible determinants of innovative activities, which have not yet been examined empirically. Though, before we present the results of the empirical analyses, we will describe the economic model and the methods used in the following section.

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14 These three German metropolitan regions were chosen due to their comparability regarding political functions (all are Federal State capitals) and their differences regarding their industrial structure (for a detailed assessment see Koch and Stahlecker, 2005). The survey is based on address data provided by the Chambers of Industry and Commerce (IHK) in the respective regions.

15 Some sub-sectors of 74 have been excluded. For example, the firms classified as "Management Activities of Holding Companies" (74.15) – up to 40 percent of the total original sample in the regions – have not been considered as KIBS.

16 The sectoral distribution of the firms included in our dataset corresponds by and large with the data provided in the *"Mannheim Foundation Panel"* of the Centre for European Economic Research (ZEW) which can be regarded as the most reliable and detailed data source for firm foundations in Germany.

4.2 Economic Model and Measurement Issues

The first problem to be addressed in an empirical analysis of firm innovative activities is the adequate measurement of innovation. More than 40 years ago, Kuznets (1962) pointed out that the greatest obstacle to comprehend the role of innovation in economic processes is the lack of suitable measures for innovation inputs and outputs.

In empirical studies of firm innovation, it is a common strategy to measure innovation either by input or by output indicators, even though there are a series of problems in measuring (for details see e.g. Rogers, 2004 or Tether, 2003), which are well known. As an input indicator, a variable might e.g. be used reflecting whether a firm invests in R&D or not. The firm's share of R&D expenditures in turnover is a more informative alternative. In this paper, we will focus on output indicators, but we will also include the share of R&D expenditures as an explaining variable. Some studies (e.g. Lynskey, 2004) use a firm's number of patents as an output measure. In other studies (see e.g. Huergo and Jaumandreu, 2004; Rogers, 2004; Becker and Dietz, 2004), innovation is proxied by some categorical variables measuring whether a firm produced some type of innovation in the preceding year(s) or not. Due to the fact that patenting is not common in the service sector we follow the latter strategy in our paper. Thereby, we primarily explain the decision to innovate, not the decision to choose a certain level of innovation.[17] Though we can not address the problem of different "qualities" or "quantities" of innovation in a truly satisfactory manner[18], we at least consider an important aspect of the intensity of innovation by distinguishing between incremental and radical innovations. In the KIBS Foundation Survey firm founders were asked whether their firm produced innovation, and, if yes, whether it did so by (1) "improving existing own services", by (2) "newly integrating existing services from other firms into their own portfolio" or by (3) "developing totally new services". While option (3) is judged as "radical innovation" the first and the second form are interpreted as "incremental innovation".[19]

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17 See for example Arvanitis (2002) for an empirical analysis for the Swiss service sector that distinguishes both kinds of decisions.

18 When using the number of patents one might expect that this is a better indicator for the "quantity" of innovation activities. However, the underlying assumption that more patents imply always better innovation activities must not hold. Knowing that we cannot address this problem of "weighting" the relevance of innovation activities, we therefore decided to draw our conclusions upon simple categorical variables.

19 As the information is based upon a self-assessment of the interviewed founders we are – as the vast majority of existing studies – not able to control for the *de facto* innovative output of the firms. Therefore, our results might be influenced by a self-appraisal of the interviewed persons.

Therefore, we define the following categorical variable to measure the innovation behavior of KIBS:[20]

$$Y_i = \begin{cases} 0 \text{ if firm i did not innovate} \\ 1 \text{ if firm i produced incremental, but no radical innovations} \\ 2 \text{ if firm i produced only or also radical innovation.} \end{cases}$$

To explain a firm's innovative activities within a multivariate framework, we follow two different estimation strategies suitable for categorical dependent variables. First, *ordered logit models* will be estimated. The underlying assumption of this type of model is that a firm's decision to innovate radically, incrementally or not can be described by an unobserved variable Y^*, and that it is possible to explain Y^* by a vector of independent variables x_i and a random component ε_i. The latter captures the non-systematic factors of influence and is assumed to be i.i.d. and logistically distributed:

$$Y_i^* = \beta' x_i + \varepsilon_i$$

with β as the vector of coefficients to be estimated. Since we can only observe the result of a firm's decision to innovate or not, we assume that a firm does not innovate if the latent variable driving the decision process is smaller than a certain threshold value s1, that it decides to produce incremental innovation if the value of Y_i^* is larger than s1, but smaller than s2 and that a firm decides to innovate radically if the latent variable is larger than s2. s1 and s2 are unknown parameters to be estimated together with β.

$$Y_i = \begin{cases} 0 & \text{if } Y_i^* = \beta' x_i + \varepsilon_i > s_1 \\ 1 & \text{if } s_1 < Y_i^* = \beta' x_i + \varepsilon_i \leq s_2 \\ 2 & \text{if } Y_i^* = \beta' x_i + \varepsilon_i \leq s_1. \end{cases}$$

We will apply the maximum likelihood method to estimate the unknown coefficient vector and to explain the probabilities of not innovating $P(Y_i = 0)$, of incremental innovation $P(Y_i = 1)$, and of radical innovations $P(Y_i = 2)$, (for details see e.g. Greene, 2003). Standard errors are estimated robustly to heteroscedasticity by using the Huber and White estimator.

The second type of model we use is the *multinomial logit model.* In contrast to the ordered logit model, the information of the ranking of the dependent variable is not used, the dependent variable is treated purely qualitative. While this loss of information might be a disadvantage, an advantage of this model is that the estimated coefficients – not to confuse with the marginal effects – are not restricted to be the same for all categories of outcome. This al-

20 Alternatively, we also used an even more detailed breakdown of the dependent variable into five categories (no innovation, only incremental innovation, only radical innovation, radical innovation and one type of incremental innovation, all types of innovation) to test the sensitivity of the results. As the main results were quite the same and the further distinction did not really lead to additional insights we do not present detailed estimations here.

lows for more flexibility to identify differences in the effects of possible determinants on the decision to innovate incrementally or radically. However, the number of parameters to be estimated is considerably larger and the validity of the independence of irrelevant alternatives assumption (IIA-assumption) has to be checked. The IIA-assumption means that the relation of the probabilities of two outcomes is always independent from the values of the other categories.

Based on the theoretical considerations and the hypotheses in section 3, our vector of variables explaining a firm's innovative activities comprises both internal capabilities, mainly of the firm founder, external linkages of the firm as well as firm-specific and – at least in a general manner – industry-specific characteristics. We put special emphasis on the role of linkages and networks of the knowledge intensive business services.[21]

The *managerial characteristics* (see hypotheses 1 and 2) are measured by a variety of variables. We proxy the professional experience of a founder by his *professional background.* A set of dummy variables control the fact whether before the foundation the founder worked at a university or similar scientific institution in the private economy – partly with the additional distinction between small and medium-sized firms and large firms – or whether he or she was self-employed or a free-lance worker. We add a dummy variable for team foundations because a *team of founders* is believed to have better access to networks and sources of external knowledge. Additionally, we take into account whether team founders have a *diversified professional background* or not, as different professional backgrounds of the founders in a team might be decisive for the innovative activities of a firm. The decision to innovate may also be stimulated if a concrete idea from the founder's former occupation was decisive for the foundation as there were already concrete linkages and ideas to build upon. Last but not least, we consider the founder's age and sex as founder-specific control variables.

With respect to the existing amount of *external linkages* of the firms (hypotheses 3 and 4) and the possible role of *spatial proximity* (hypothesis 5) for innovation, we also include several indicators into the model. At first, we consider whether the KIBS have *access to science-related external knowledge* by partners from universities or research laboratories, *access to knowledge by clients, suppliers or other firms from the private economy and/or access to knowledge by partners from other public institutions* such as administrations or chambers for example. In addition to this mere information of having cooperation partners or not, we include information about the form and intensity of the cooperation (e.g. cooperation contracts, joint projects, mission oriented research, informal contacts). A dummy variable indicates whether the services of a firm enter into the R&D-process, the production process or internal or-

21 As our analyses focus on newly founded KIBS there is less heterogeneity in our sample with respect to firm size, industries and firm age than in studies dealing with the manufacturing sector or the service sector in total.

ganization measures of their clients ("*close integration into their clients innovation processes*") or whether they only enter into sales and distribution or as non-technical advice ("no close integration into their clients innovation processes").

We test the hypothesis that a founder who stems from the region has already more pronounced linkages, and, therefore, perhaps better access to knowledge with a dummy variable that measures whether the *last occupation of the founder was within the region* or not. If, in contrast, access to knowledge for innovation is not bound to regional contacts, we should not expect a positive impact on a firm's innovation behavior. A possible impact of a regional lead client on a firm's innovative activity is measured by a simple dummy variable, and we add the *share of turnover earned from manufacturing clients* to examine whether a close relationship of KIBS to clients from manufacturing helps to stimulate firm innovation.

As *firm-specific control variables*, *firm size*, either as the logarithm of employment in 2003 or dummy variables for the categories, and *firm age* are included. Existing studies for manufacturing or the service sector as a whole indicate that firm innovation depends positively on size and negatively on age – though often in a nonlinear way. As we measure innovation by a simple output measure, we expect that the probability of innovation increases with a firm's investment in R&D input into the innovation processes. The *share of R&D expenditures from total turnover* shall indicate whether more input in R&D helps to produce innovation and in particular radical innovation.

Finally, we include a set of sectoral dummy variables into the model to account for *sector-specific factors* as e.g. costs of innovation, the expected demand conditions in different industries of the KIBS sector, the degree of price competition and non-price competition in the market and market structure explicitly in this study.

5. Empirical Results

5.1 Descriptive Statistics

After dropping observations with missing values in any of the relevant variables, 489 firms remain for the following multivariate analyses. Almost 13 percent of the KIBS (63 firms) answered that they produced neither incremental nor radical innovation since their foundation. While 72 firms (15 percent) innovated at most incrementally, the majority of firms (72 percent) answered that they produced also or only radical innovation.[22]

22 With respect to the three regions analyzed we do not find significant differences in the innovation behavior of the KIBS. In Bremen, 73 percent of the firms are radical innovators and 13 percent innovate only incrementally. In Munich the corresponding shares are 72 percent and 15 percent and in Stuttgart 71 percent and 15 percent.

Table 10.1: Descriptive statistics

	Mean	St.dev.	Min.	Max.	Median
Managerial/internal capabilities					
Professional background: scientific research (ref.: private economy)	0.14	0.34	0	1	0
Professional background: self-employed (ref.: private economy)	0.35	0.48	0	1	0
Concrete idea from an earlier occupation led to foundation (1 = yes)	0.85	0.36	0	1	1
Team foundation (1 = yes)	0.62	0.49	0	1	1
Team foundation with diversified professional background of team founders (1 = yes)	0.27	0.44	0	1	0
External linkages and spatial proximity					
Access to knowledge by partners from universities etc. (1 = yes)	0.37	0.48	0	1	0
Access to knowledge by partners from clients, suppliers or other firms (1 = yes)	0.67	0.47	0	1	1
Access to knowledge by partners from other public institutions (1 = yes)	0.11	0.32	0	1	0
Intense cooperation with partners from universities etc. (1 = yes)	0.22	0.41	0	1	0
Intense cooperation with partners from private economy (1 = yes)	0.38	0.49	0	1	0
Closeness of integration into the customers' innovation processes (1 = close)	0.72	0.45	0	1	1
Share of turnover with clients from manufacturing (%)	0.50	0.36	0	1	0.5
Regional lead customer with crucial influence on foundation (1 = yes)	0.30	0.46	0	1	0
Firm-specific determinants					
R&D-expenditures (share of total turnover in %)	0.17	0.25	0	2.6	0.1
Firm size (log. of employment 2003)	1.51	0.97	0	5.01	1.39
Firm age (in years)	3.63	2.00	0	7	3
Age of the founder (in years)	41.76	8.79	18	67	41
Sex of the founder (1 = male)	0.87	0.33	0	1	1
Industry-specific determinants					
Software (ref.: technical services)	0.17	0.38	0	1	0
Other activities related to data processing (ref.: technical services)	0.21	0.41	0	1	0
Consultancy (ref.: technical services)	0.21	0.41	0	1	0
Advertisement (ref.: technical services)	0.17	0.38	0	1	0

Source: KIBS Foundation Survey 2003, n=489

Table 10.1 gives the descriptive statistics of the variables included in the models. A comparison of the descriptive statistics with those for the whole sample of 547 firms shows that there does not seem to be a severe bias due to the missing values.

5.2 Results from Ordered Logit Models

First, we present results for the estimation of ordered logit models taking into account the ranking of the dependent variable. In section 5.3, we will then analyze whether the application of a multinomial logit model leads to additional insights.

To check the sensitivity of the results a large variety of ordered logit models were estimated. As the findings are generally rather stable and do not depend on the concrete choice of the model, we only present four different models (see table 10.2).

Table 10.2: Determinants of innovation in newly founded KIBS (results of ordered logit estimation, robust p-values in parentheses)

Dependent variable: 0 = no innovation, 1 = incremental innovation, 2 = radical innovation				
	(1)	(2)	(3)	(4)
Managerial/internal capabilities				
Age of the founder (in years)	-0.014 (0.270)	-0.013 (0.286)	-0.014 (0.271)	-0.017 (0.192)
Sex of the founder (1 = male)	0.586 (0.088)*	0.659 (0.064)*	0.650 (0.069)*	0.655 (0.066)*
Professional background: scientific research (ref.: private economy)	0.319 (0.397)	0.206 (0.617)	0.226 (0.581)	0.269 (0.514)
Professional background: self-employed (ref.: private economy)	-0.174 (0.474)	-0.226 (0.349)	-0.196 (0.423)	-0.200 (0.420)
Concrete idea from an earlier occupation led to foundation (1 = yes)	0.224 (0.458)	0.305 (0.330)	0.268 (0.403)	0.259 (0.421)
Team foundation (1 = yes)	0.152 (0.571)	0.197 (0.472)	0.195 (0.481)	0.198 (0.469)
Team foundation with diversified prof. background of team founders (1 = yes)	-0.467 (0.110)	-0.540 (0.078)*	-0.567 (0.065)*	-0.564 (0.067)*
External linkages and spatial proximity				
Access to knowledge by partners from universities etc. (1 = yes)	0.725 (0.004)***	0.583 (0.055)*	0.643 (0.037)**	0.703 (0.019)**
Access to knowledge by partners from clients, suppliers or other firms (1 = yes)	0.046 (0.849)	-0.442 (0.112)	-0.434 (0.122)	-0.457 (0.113)
Access to knowledge by partners from other public institutions (1 = yes)	0.813 (0.048)**	0.894 (0.038)**	0.927 (0.033)**	0.937 (0.031)**
Intense cooperation with partners from universities etc. (1 = yes)		0.507 (0.286)	0.445 (0.352)	0.381 (0.424)
Closeness of integration into the custom- ers' innovation processes (1 = close)	0.425 (0.077)*	0.467 (0.057)*	0.408 (0.097)*	0.377 (0.127)

Continuation *table 10.2*

Dependent variable: 0 = no innovation, 1 = incremental innovation, 2 = radical innovation				
	(1)	(2)	(3)	(4)
Share of turnover with clients from manufacturing (%)			0.232 (0.441)	0.256 (0.396)
Regional lead customer with crucial influence on foundation (1 = yes)	0.101 (0.692)	0.073 (0.779)	0.059 (0.825)	0.046 (0.864)
Firm-specific determinants				
R&D-expenditures (share of total turnover in %)	4.160 (0.001)***	4.037 (0.001)***	3.930 (0.002)***	4.023 (0.001)***
Firm size (log. of employment 2003)	0.176 (0.145)	0.170 (0.171)	0.179 (0.154)	
5 to 10 employees (ref.: 1-4 employees)				0.391 (0.164)
11 to 20 employees (ref.: 1-4 employees)				-0.079 (0.842)
More than 20 employees (ref.: 1-4 employees)				0.776 (0.077)*
Firm age (in years)	0.028 (0.623)	0.036 (0.545)	0.031 (0.596)	0.034 (0.574)
Industry-specific determinants				
Software (ref.: technical services)	0.399 (0.257)	0.363 (0.309)	0.365 (0.323)	0.315 (0.389)
Other activities related to data processing (ref.: technical services)	0.392 (0.231)	0.524 (0.121)	0.488 (0.162)	0.467 (0.180)
Consultancy (ref.: technical services)	0.398 (0.173)	0.361 (0.213)	0.341 (0.248)	0.315 (0.291)
Advertisement (ref.: technical services)	1.267 (0.002)***	1.314 (0.001)***	1.272 (0.003)***	1.242 (0.003)***
Observations	489	489	482	482
Pseudo R^2	0.144	0.138	0.135	0.139
Log-likelihood	-337.9	-328.7	-324.9	-323.6
Wald-Test	59.57 (0.000)***	65.28 (0.000)***	64.28 (0.000)***	65.57 (0.000)***
Test for joint significance of the industry dummies	9.76 (0.045)**	10.28 (0.036)**	9.07 (0.059)*	8.69 (0.070)*
Likelihood of the corresponding multinomial logit model	-324.1	-313.3	-307.9	-306.3
Plausibility test of goodness of fit compared to a multinomial logit, p values	0.091*	0.074*	0.049**	0.074*

*/**/*** significant at 10/5/1%-levels, respectively. Source: KIBS Foundation Survey 2003.

To enable a more meaningful interpretation of the results of ordered logit estimations, we will consider the marginal effects of a change of an explaining variable to each outcome of the dependent variable. Table 10.3 presents the marginal effects for model 4. The results for the other models are quite similar.

Considering *firm-specific characteristics*, one can conclude that for innovative activities in newly founded KIBS we cannot find strong empirical evidence for the Schumpeterian hypothesis of a comparative advantage in innovative activities for large firms. Though the sign of the logarithm of employment used as an indicator for firm size is always positive, the relationship is nonetheless insignificant. If one considers a set of firm size dummy variables instead of the continuous variable then a slightly different situation occurs. The probability that KIBS produce radical innovation is significantly larger, approximately 10.6 percentage points, for firms with 20 + employees compared to small firms with four or less employees. It has to be noted, however, that the firm size distribution in the KIBS sector is rather different from the size distribution. For example, in the manufacturing sector firms with 20 or more employees are still considered as small firms.

Table 10.3: Determinants of innovation in newly founded KIBS (results of ordered logit estimation, marginal effects, robust p values in parentheses)

	Marginal effects for model (4) from table 10.2		
	0 No innovation	1 Incremental innovation	2 Radical innovation
Managerial/internal capabilities			
Age of the founder (in years)	0.001 (0.201)	0.002 (0.196)	-0.003 (0.194)
Sex of the founder	-0.058 (0.140)	-0.066 (0.082*)	0.124 (0.103)
Professional background: scientific research (ref.: private economy)	-0.018 (0.479)	-0.025 (0.495)	0.042 (0.488)
Professional background: self-employed (ref.: private economy)	0.015 (0.439)	0.019 (0.421)	-0.034 (0.428)
Team foundation (1 = yes)	-0.014 (0.476)	-0.019 (0.472)	0.033 (0.473)
Team foundation with diversified prof. background of team founders (1 = yes)	0.045 (0.089*)	0.056 (0.078*)	-0.101 (0.079*)
Concrete idea from an earlier occupation led to foundation (1 = yes)	-0.020 (0.455)	-0.025 (0.433)	0.045 (0.442)
External linkages and spatial proximity			
Access to knowledge by partners from universities etc. (1 = yes)	-0.047 (0.024**)	-0.064 (0.018**)	0.111 (0.017**)
Access to knowledge by partners from clients, suppliers or other firms (1 = yes)	0.031 (0.091*)	0.042 (0.106)	-0.073 (0.095*)
Access to knowledge by partners from other public institutions (1 = yes)	-0.050 (0.009***)	-0.075 (0.007***)	0.125 (0.006***)
Intense cooperation with partners from universities etc. (1 = yes)	-0.025 (0.370)	-0.035 (0.399)	0.060 (0.386)
Intense cooperation with partners from private economy (1 = yes)	-0.068 (0.003***)	-0.092 (0.001***)	0.160 (0.001***)
Closeness of integration into the custom- ers' innovation processes (1 = close)	-0.029 (0.163)	-0.037 (0.135)	0.066 (0.143)

Continuation *table 10.3:*

	Marginal effects for model (4) from table 10.2		
	0 No innovation	1 Incremental innovation	2 Radical innovation
Share of turnover with clients from manufacturing (%)	0.000 (0.409)	0.000 (0.398)	0.000 (0.401)
Regional lead customer with crucial influence on foundation (1 = yes)	-0.003 (0.865)	-0.004 (0.864)	0.008 (0.863)
Firm-specific determinants			
R&D-expenditures (share of total turnover in %)	-0.003 (0.000***)	-0.004 (0.001***)	0.007 (0.000***)
5 to 10 employees (ref.: 1 to 4 employees)	-0.026 (0.145)	-0.036 (0.150)	0.062 (0.144)
11 to 20 employees (ref.: 1 to 4 employees)	-0.006 (0.845)	0.008 (0.843)	-0.013 (0.844)
More than 20 employees (ref.: 1 to 4 employees)	-0.043 (0.025**)	-0.063 (0.038**)	0.106 (0.029**)
Firm age (in years)	-0.002 (0.578)	-0.003 (0.576)	0.006 (0.576)
Industry-specific determinants			
Software (ref.: technical services)	-0.021 (0.354)	-0.029 (0.365)	0.049 (0.358)
Other activities related to data processing (ref.: technical services)	-0.030 (0.138)	-0.042 (0.152)	0.072 (0.142)
Consultancy (ref.: technical services)	-0.021 (0.260)	-0.029 (0.271)	0.050 (0.264)
Advertisement (ref.: technical services)	-0.065 (0.000***)	-0.100 (0.000***)	0.162 (0.000***)

*/**/*** significant at 10/5/1%-levels, respectively. Source: KIBS Foundation Survey 2003.

With respect to a possible age dependence of innovation in the KIBS sector we do not find empirical evidence for a positive or negative relationship. However, as the question about innovation in our survey did not refer to a certain period before the interrogation one could be surprised to find that younger KIBS did not produce less innovation than their older counterparts. Also one should keep in mind that our survey focused on firms founded since 1996 and thus not older than seven years.

Considering the engagement of a firm in R&D one should clearly expect that the probability of radical and/or incremental innovation increases if a firm invests a larger share of its turnover into R&D. The results confirm that for radical innovation this positive impact is highly significant.

The age of the *founder* seems to have a slight negative impact on the probability to perform radical innovation, though statistical significance is not given. The coefficients of the sex dummy are positive and at least weakly statistically significant in all the models. This means that the probability to inno-

vate radically is larger for male founders than for female founders.[23] The marginal effect for radical innovation is about 12.4 percentage points and slightly significant, whereas the marginal effects for incremental innovation and no innovation are negative.[24]

In the ordered logit regressions, the professional background of the founder as a measure of his/her *professional capabilities* cannot be shown to have a significant impact on the decision to innovate.[25] Though the coefficients for a scientific background are always positive compared to founders stemming from the private economy, and albeit the coefficients for formerly self-employed or free-lancing founders are always negative, the relationship is not statistically significant.[26] Whether a concrete idea from a former occupation led to the foundation or not, it does not explain the probability of innovation. Also, team foundations do not have a higher probability to innovate incrementally or radically than start-ups founded by a single person. In the models shown in tables 10.2 and 10.3 the team variable was split into two variables. One measures whether a start-up is a team foundation or not and a second interaction variable measures whether a team of founders has a diversified professional background or not. As one may assume that the teams with founders from different backgrounds could be more innovative due to information advantages than team foundations where all the founders have the same background. However, our results do not confirm this hypothesis. In contrast, team foundations with diversified professional background even produce, at least slightly, less innovation than team foundations that do not have diversified founders.

To summarize, we do not find empirical evidence for our hypothesis (H1) that the professional background of the founder(s) is decisive for firm innovation. Moreover, team foundations do not show to innovate more intensely than start-ups of a single founder (H2).

With respect to the role of *external linkages*, our multivariate analyses clearly confirm the importance of interaction and networking for innovation behavior. The hypothesis that access to knowledge and information is of utmost importance for the innovative activities of KIBS (H3) can clearly be underlined by our empirical results. In particular, access to scientific institutions and universities leads to a considerably higher probability to produce radical innovations (see at first model 1). Alike, the access to knowledge of partners

23 This may partly result from the fact that women are working in less innovative sectors than men and that our sectoral dummy variables might not totally capture this effect.

24 Unfortunately, we can only speculate about the reasons for this result in this paper. It might be explained by differences in risk aversion, network access or simply by the fact that men overstate the amount of innovation they produced in a systematic manner.

25 We will have to modify this finding at least a bit when analyzing the results of the multinomial logit estimation in section 5.3.

26 We will modify this latter result when discussing the findings from the multinomial logit models in section 5.3.

from other public institutions (e.g. public administration or chambers) has a positive and significant impact on the probability to innovate radically. It might be surprising at the first glance that the probability to innovate radically does not positively depend upon the access to knowledge by suppliers, clients and other firms from the private economy. However, we can shed some light on this by additionally taking into account the intensity of cooperation (H4). In models 2 to 4, we add two variables measuring the form and the intensity of cooperation with partners from universities etc. and private firms. We gain additional insight considering the impact of partnership and access to knowledge on the decision to innovate. While with respect to external scientific knowledge, it is important to have cooperation partners there seems to be no (additional) need for formal cooperative contracts or similar ways of intense cooperation. The results for access to knowledge by firm partners are rather different: though, there is no significant impact of this kind of access on innovation in general, there is a remarkable positive impact on the probability to innovate radically if a KIBS firm cooperates with suppliers, clients or other firms in a more formal and, therefore, intense manner. KIBS with cooperative contracts, joint projects or mission oriented research with other private firms have a highly significant larger probability to produce radical innovations than firms whose contacts to other firms are rather informal und less intense. This result is consistent with the assumption that the probability of radical innovation is larger if newly founded KIBS are closely integrated into the R&D processes of their customers though the significance of this relationship is not given in every case.

One may also expect that KIBS, which earn a large share of their turnover from manufacturing clients, might be forced to innovate more frequently and more intensively. In the ordered logit framework, however, we do not find a significant influence from manufacturing clients on the innovation decisions of KIBS start-ups. We will have to modify this result at least to some extent when discussing the findings from multinomial logit models in section 5.3.

In our analysis, the variables considering a possible role of spatial proximity do not indicate a significant relation between spatial proximity and firm innovation. In particular, there is no impact at all on the probability to innovate if the founders stem from the region.[27] We also included dummy variables for the three regions Bremen, Munich and Stuttgart into our models. However, as the dummies were never significant and as they do not have a joint impact on the innovative behavior of the KIBS we restrained them from presenting them within this study. Moreover, an impact of a regional lead client influencing the decision to start-up on the probability to innovate could not be proved.

27 As the p-value of this variable was typically over 0.8 we did not present results including this variable.

The dummy variables for the different sub-sectors of the KIBS sector are – at least weakly – jointly significant. This emphasizes that differences in innovative activities can at least be partly explained by sectoral characteristics as market structure, expected demand, price and quality competition, and so on.

5.3 Results from Multinomial Logit Models

The estimation of ordered logit models has the advantage that the information of the order of the dependent variable (here: no innovation, incremental innovation, radical innovation) is used. However, the determinants of "radical innovation" may be rather different from "no innovation" and "incremental innovation". To check for the sensitivity of the results and to gain further insights into these possible differences we additionally estimate the corresponding multinomial logit models where the coefficient does not have to be the same for all categories of outcome. Some plausibility tests for the goodness of fit of the ordered logit model suggest that this might be a promising idea as the rather large values of the chi-squared statistic indicate that a multinomial logit model might be a feasible alternative (see table 10.2).[28]

The central assumption for applying a multinomial logit model is the assumption of the independence of irrelevant alternatives (IIA-assumption).[29] A Hausman test does not reject the null hypothesis that the IIA-assumption is fulfilled in any single case. The Small-Hsiao test of the IIA-assumption leads to partly inconsistent results, which have to be taken into account when interpreting the results. Likelihood-ratio tests and corresponding Wald tests for combining outcome categories all lead to the result that it is reasonable to distinguish between the three categories "no innovation", "incremental innovation" and "radical innovation" without combining two of these outcomes.

Table 10.4 presents the results of the multinomial logit estimations, whereby, the outcome "no innovation" was chosen as the base category. In the following, we do not refer to every single result, but point out some additional insights gained by applying the multinomial logit instead of ordered logit estimation.

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28 The test we applied is only "suggestive" as the ordered logit model is not nested within the multinomial logit model. We compared the likelihood value of the ordered logit model with that obtained by fitting a multinomial logit by applying a common likelihood ratio test. The procedure is explained in Hamilton (2002, 102).

29 For a more detailed explanation of this assumption see e.g. Greene (2003).

Table 10.4: Results from multinomial logit estimation (coefficient of "no innovation" = 0, robust p values in parentheses)

	Model 1		Model 2		Model 3		Model 4	
	Incremental innovation	Radical innovation	Incremental innovation	Radical innovation	Incremental innovation	Radical innovation	Incremal innovation	Radical innovation
Managerial/internal capabilities								
Age of the founder	0.001 (0.983)	-0.018 (0.298)	-0.000 (0.996)	-0.017 (0.322)	-0.004 (0.867)	-0.019 (0.278)	-0.004 (0.869)	-0.020 (0.243)
Sex of the founder	0.536 (0.334)	0.735 (0.072)*	0.538 (0.331)	0.797 (0.060)*	0.515 (0.350)	0.776 (0.068)*	0.511 (0.353)	0.774 (0.072)*
Professional background: scientific research (ref.: private economy)	-0.060 (0.926)	0.253 (0.650)	0.066 (0.921)	0.263 (0.656)	0.175 (0.791)	0.334 (0.567)	0.200 (0.762)	0.380 (0.511)
Professional background: self-employed (ref.: private economy)	-1.018 (0.015)**	-0.632 (0.049)**	-1.118 (0.008)***	-0.725 (0.025)**	-1.073 (0.012)**	-0.684 (0.041)**	-1.104 (0.010)**	-0.708 (0.039)**
Concrete idea from an earlier occupation led to foundation (1 = yes)	0.594 (0.239)	0.386 (0.288)	0.692 (0.178)	0.535 (0.168)	0.706 (0.175)	0.526 (0.196)	0.703 (0.178)	0.508 (0.209)
Team foundation (1 = yes)	0.410 (0.364)	0.315 (0.387)	0.462 (0.319)	0.378 (0.326)	0.580 (0.220)	0.465 (0.241)	0.589 (0.214)	0.472 (0.230)
Team foundation with diversified prof. background of team founders (1 = yes)	0.193 (0.718)	-0.393 (0.379)	0.162 (0.769)	-0.466 (0.314)	0.173 (0.760)	-0.489 (0.299)	0.180 (0.755)	-0.490 (0.307)
External linkages and spatial proximity								
Access to knowledge by partners from universities etc. (1 = yes)	-0.054 (0.904)	0.737 (0.044)**	0.493 (0.358)	0.870 (0.061)*	0.569 (0.319)	0.967 (0.052)*	0.635 (0.244)	1.063 (0.024)**
Access to knowledge by partners from clients, suppliers or other firms (1 = yes)	0.615 (0.126)	0.282 (0.367)	0.179 (0.682)	-0.469 (0.199)	0.259 (0.565)	-0.419 (0.267)	0.254 (0.575)	-0.446 (0.247)
Access to knowledge by partners from other public institutions (1 = yes)	1.886 (0.022)**	1.973 (0.008)***	1.998 (0.016)**	2.138 (0.005)***	2.178 (0.008)***	2.290 (0.002)***	2.297 (0.004)***	2.410 (0.001)***

Continuation *table 10.4*

	Model 1		Model 2		Model 3		Model 4	
	Incremental innovation	Radical innovation	Incremental innovation	Radical innovation	Incremental innovation	Radical innovation	Incremal innovation	Radical innovation
Intense cooperation with partners from universities etc. (1 = yes)			-1.286 (0.142)	-0.199 (0.775)	-1.329 (0.130)	-0.277 (0.695)	-1.362 (0.108)	-0.359 (0.595)
Intense cooperation with partners from private economy (1 = yes)			1.006 (0.074)*	1.569 (0.001)***	0.961 (0.091)*	1.568 (0.002)***	1.001 (0.079)*	1.644 (0.001)***
Closeness of integration into the customers' innovation processes	0.799 (0.049)**	0.750 (0.012)**	0.847 (0.044)**	0.840 (0.008)***	0.694 (0.104)	0.729 (0.023)**	0.691 (0.109)	0.709 (0.029)**
Share of turnover with clients from manufacturing					1.132 (0.043)**	0.728 (0.105)	1.175 (0.037)**	0.788 (0.082)*
Regional lead customer with crucial influence on foundation (1 = yes)	-0.804 (0.066)*	-0.289 (0.404)	-0.899 (0.046)**	-0.371 (0.294)	-1.050 (0.027)**	-0.480 (0.199)	-1.046 (0.026)**	-0.491 (0.188)
Firm-specific determinants								
R&D-expenditures (share of total Turnover in %)	2.172 (0.439)	5.467 (0.042)**	1.909 (0.464)	5.136 (0.037)**	1.525 (0.555)	4.833 (0.046)**	1.679 (0.519)	5.036 (0.040)**
Firm size (log. of employment 2003)	0.181 (0.368)	0.267 (0.153)	0.218 (0.310)	0.281 (0.162)	0.161 (0.464)	0.260 (0.202)		
5 to 10 employees (ref: 1-4 employees)							0.514 (0.268)	0.702 (0.076)*
11 to 20 employees (ref: 1-4 employees)							-0.052 (0.942)	-0.099 (0.873)
More than 20 employees (ref: 1-4 employees)							0.325 (0.717)	0.917 (0.268)
Firm age (in years)	-0.003 (0.979)	0.024 (0.761)	-0.018 (0.855)	0.020 (0.807)	-0.030 (0.757)	0.010 (0.899)	-0.025 (0.807)	0.015 (0.859)
Industry-specific determinants								
Software (ref.: technical services)	0.697 (0.256)	0.724 (0.175)	0.775 (0.200)	0.755 (0.145)	0.840 (0.187)	0.785 (0.151)	0.767 (0.228)	0.701 (0.201)

Continuation *table 10.4*

	Model 1		Model 2		Model 3		Model 4	
	Incremental innovation	Radical innovation	Incremental innovation	Radical innovation	Incremental innovation	Radical innovation	Incremal innovation	Radical innovation
Other activities related to data processing (ref.: technical services)	0.299 (0.590)	0.557 (0.230)	0.495 (0.393)	0.788 (0.115)	0.609 (0.310)	0.794 (0.127)	0.637 (0.289)	0.808 (0.119)
Consultancy (ref.: technical services)	0.466 (0.397)	0.603 (0.158)	0.522 (0.346)	0.598 (0.168)	0.562 (0.314)	0.602 (0.171)	0.599 (0.287)	0.605 (0.174)
Advertisement (ref.: technical services)	0.454 (0.526)	1.475 (0.004)***	0.511 (0.481)	1.576 (0.002)***	0.531 (0.475)	1.573 (0.004)***	0.579 (0.445)	1.599 (0.005)***
Constant	-2.278 (0.093)*	-0.888 (0.413)	-2.375 (0.080)*	-1.178 (0.290)	-2.638 (0.063)*	-1.353 (0.262)	-2.634 (0.062)*	-1.184 (0.317)
Observations	489	489	489	489	482	482	482	482
Log-likelihood	-324.1		-313.3		-307.9		-306.3	
Wald-model-test	97.91 (0.000)***		102.31 (0.000)***		102.27 (0.000)***		109.49 (0.000)***	
Pseudo R-squared	0.1504		0.1787		0.1805		0.1848	
Wald-Test for joint significance of the industry dummies	1.47 (0.833)	8.37 (0.079)*	1.87 (0.760)	9.46 (0.051)*	2.06 (0.725)	8.58 (0.073)*	1.98 (0.733)	8.24 (0.083)
Wald-test for combining outcomes (H_0: categories can be collapsed								
test for combining 1 und 2	0.015***		0.001***		0.002***		0.001***	
test for combining 1 und 0	0.097*		0.125		0.070*		0.043**	
test for combining 2 und 0	0.000***		0.000***		0.000***		0.000***	

significant at 10 percent ** significant at 5 percent; *** significant at 1 percent. Source: KIBS Foundation Survey 2003.

Within the multinomial logit framework, the general results from the ordered logit regressions can almost all be confirmed. However, we gain some additional insights into the differences between the determinants of incremental and radical innovation. We find that the input in R&D leads to a statistically highly significant positive impact on the probability to produce radical innovation, but there is no reliable impact on the probability of incremental innovation. A LR-test of the significance of the difference between the coefficient estimates shows that this difference is highly significant (p-value: 0.001).

The upper findings with respect to the serious importance of access to knowledge by partners for innovation are distinctively underlined within a multinomial logit framework. Thereby, access to external scientific knowledge is particularly important for radical innovation, but not for incremental innovation. The impact of a close interaction with suppliers, clients or other firms from the private economy on a firm's decision to innovate is positive both for incremental innovation and even more distinctive for radical innovation.

In contrast to the results of the ordered logit model, the positive impact of manufacturing clients on the probability to innovate becomes significant. As a result, having clients from the manufacturing sector is more important for incremental innovation than for radical innovation though the difference is not significant. A further modification of the findings is that the probability to produce incremental and radical innovation is significantly lower for founders who were self-employed or free-lance workers before founding, whereas the difference between founders from universities or scientific institutions or founders from the private economy again is not significant. A regional lead customer who was important for the foundation does again neither hamper nor foster the probability of radical innovation. Yet, there is some evidence that it might hamper the probability to produce incremental innovation.

6. Summary and Conclusion

Existing empirical studies on firm innovation in the service sector and the KIBS sector are mostly based on case study evidence, the analyses of small samples or highly aggregated sectoral or regional data. The present paper supplements this literature by examining the determinants of firm innovative activity in the KIBS sector using firm micro data, thereby focusing on newly-founded KIBS. On the basis of the KIBS Foundation Survey 2003, a newly conducted dataset of 547 start-up firms in three German agglomeration regions, we are able to analyze possible determinants of innovation. In particu-

lar, the possible role of managerial characteristics of the founder(s), of the external linkages, interaction and networking and of spatial proximity, all of which so far have not been analyzed within multivariate analyses.

The central hypotheses examined in this study are that, due to the specific characteristics of start-up firms in the KIBS sector, managerial characteristics of the firm founders as well as interactive behavior of the firms, namely cooperation and networking, are decisive determinants of firm innovation.

Our empirical study strongly supports the hypotheses about the pivotal role of the access to knowledge in innovation processes, also in the service sector. Particularly when accomplishing radical innovation, access to formal knowledge (from universities etc.) is of major importance. A very interesting result of our empirical analyses is that for radical innovation, access to knowledge from universities and research institutions has a significantly positive influence. Whereas formal cooperation with these institutions does not increase the probability to innovate radically. In contrast, access to knowledge via private partners has no significant influence on the probability to perform radical innovation while cooperation with these partners has a highly significant impact.

The integration into R&D processes of clients and suppliers turned out to be an important determinant of innovative activity. Spatial proximity, on the other hand, which is claimed to be relevant by many authors with strong theoretical arguments, did not play a significant role in our estimations. On the contrary, having a regional lead customer during the early stages of a firm's development surprisingly appears to have a small, but significant negative impact on the realization of incremental innovations.

With respect to the managerial characteristics of the founders we find that they do not help explaining the innovative activities of the examined firms in a significant manner. Former self-employment seems to hamper firm innovation compared to founders who worked at a university or a comparable scientific institution or private firm before. Though this result might partially be explained by a more critical self-assessment of formerly self-employed or free-lancing persons, we cannot confirm the hypothesis that applied technological and organizational experiences of the founder(s) enhance the probability to innovate. One might suppose that the appraisals of the significance of user-producer interaction and the importance of managerial characteristics and prior knowledge have to be partially rethought regarding the KIBS sector.

Certainly, this study leaves some questions unanswered. A big problem every empirical study of innovation faces is the definition and measurement of innovation. As there is usually no patenting in the service sector and as the assessment of patents has its own problems, the information about innovations in this study has to be based on a rather soft criterion of innovation output, on simple questions whether a firm performs innovative activity or not and of which kind (incremental, radical). We do not know how efficiently an innovation was realized nor do we know the number or even the value of the

innovations.[30] Also with respect to our explaining variables, the managerial characteristics, external linkages and in particular spatial proximity, one should think of different possibilities in measuring them for future studies to confirm or question the findings of our study which took a first step in considering them within a multivariate framework. Moreover, it could be interesting not only to address the decision of a firm to innovate, but also its success in realizing the innovations and in bringing them to the market effectively.

Therefore, in future studies it would be desirable to examine these questions by expanded and adapted research designs, in particular by carrying out a panel study revealing the determinants of successful innovation in the service sector. From a theoretical point of view, it is necessary to carry on the work on concepts to measure innovative activity in the service sector.

References

Acs, Zoltan J. and Audretsch, David B., 1990, *Innovation and small firms.* Cambridge (MA): MIT Press.

Arvanitis, Spyros, 2002, Explaining innovative activity in service industries: Micro data evidence for Switzerland. *ETH Zürich Working Papers No. 56.*

Audretsch, David B., Klomp, Luuk and Thurik, Roy A. 1999, "Do services differ from manufacturing? The post-entry performance of firms in Dutch services." In *Innovation, industry, evolution, and employment*, David B. Audretsch and Roy A. Thurik, eds. Cambridge: Cambridge University Press.

Becker, Wolfgang and Dietz, Jürgen, 2004, R&D cooperation and innovation activities of firms – evidence for the German manufacturing industry. *Research Policy*, 33, 209-23.

Brixy, Udo and Grotz, Reinhold, 2004, „Regionale Muster und Determinanten des Gründungserfolgs". In *Empirische Analysen zum Gründungsgeschehen in Deutschland,* Michael Fritsch and Reinhold Grotz, eds. Heidelberg: Physica.

Cohen, Wesley M., 1995, "Empirical studies of innovative activity." In *Handbook of the economics of innovation and technological change,* Paul Stoneman, ed. Oxford, Cambridge (MA): Blackwell.

Cohen, Wesley M. and Levinthal, Daniel A. 1989, Innovation and learning: The two faces of R&D. *The Economic Journal*, 99, 569-96.

Czarnitzki, Dirk and Spielkamp, Alfred, 2003, Business services in Germany: bridges for innovation. *The Service Industries Journal*, 23, 1-30.

Dosi, Giovanni, 1988, "The nature of the innovative process." In *Technical change and economic theory,* Giovanni Dosi, Christopher Freeman, Richard Nelson, Gerald Silverberg and Luc Soete, eds. New York: Pinter.

Deephouse, David L. 1999, To be different, or to be the same? It's a question (and theory) of strategic balance. *Strategic Management Journal*, 20, 147-66.

Drejer, Ina, 2004, Identifying innovation in surveys of services: A Schumpeterian perspective. *Research Policy*, 33, 551-62.

30 It seems questionable whether it would be actually possible to obtain this information.

Elfring, Tom and Hulsink, Willem, 2003, Networks in entrepreneurship: The case of high-technology firms. *Small Business Economics*, 21, 409-22.

Freel, Mark, 2000, External linkages and product innovation in small manufacturing firms. *Entrepreneurship & Regional Development*, 12, 245-66.

Gallouj, Faïz and Weinstein, Oliver, 1997, Innovation in services. *Research Policy*, 26, 537-56

Granovetter, Mark, 1973, The strength of weak ties. *American Journal of Sociology*, 78, 1360-80.

Greene, Walter H., 2003, *Econometric analysis*. New Jersey: Prentice Hall.

Haas, Hans-Dieter and Lindemann, Susanne, 2003, Wissensintensive unternehmensorientierte Dienstleistungen als regionale Innovationssysteme. *Zeitschrift für Wirtschaftsgeographie*, 47, 1-14.

Hamilton, Lawrence C., 2002, *Statistics with Stata*. Belmont, CA: Duxbury.

Howells, Jeremy R.L., 2002, Tacit knowledge, innovation and economic geography. *Urban Studies*, 39, 871-84.

Huergo, Elena and Jaumendreu, Jordi, 2004, How does probability of innovation change with firm age? *Small Business Economics*, 22, 193-207.

Illeris, Sven, 1994, Proximity between service producers and service users. *Tijdschrift voor Economische en Sociale Geografie*, 85, 294-302.

Johannisson, Bengt, 1998, Personal networks in emerging knowledge-based firms: spatial and functional patterns. *Entrepreneurship & Regional Development*, 10, 297-312.

Klepper, Steven, 2001, Employee startups in high-tech industries. *Industrial and Corporate Change*, 10, 639-74.

Koch, Andreas and Stahlecker, Thomas, 2004, Social networks, relational and spatial proximity. Founding processes and early development of KIBS start-ups, *Paper presented at the 13th Nordic Conference on Small Business Research*. Tromsø, Norway, June 10-12.

Koch, Andreas and Stahlecker, Thomas, 2005, Regional innovation systems and the foundation of knowledge intensive business services. *European Planning Studies* 2005, forthcoming.

Koch, Andreas and Strotmann, Harald, 2005, The impact of functional integration and spatial proximity on the post-entry performance of knowledge intensive business service firms. *IAW Discussion Paper No. 18,* January.

Kuznets, Simon, 1962, "Inventive activity. Problems of definition and measurement." In *The rate and direction of inventive activity: Economic and social factors,* National Bureau of Economic Research, ed. Princeton: Princeton University Press.

Love, James H. and Roper, Stephen, 2001, Location and network effects on innovation success: evidence for UK, German and Irish manufacturing plants. *Research Policy*, 30, 643-61.

Lundvall, Bengt-Åke, 1988, "Innovation as an interactive process: from user-producer interaction to the national system of innovation." In *Technical change and economic theory,* Giovanni Dosi, Christopher Freeman, Richard Nelson, Gerald Silverberg and Luc Soete, eds. London, New York: Pinter.

Lynskey, Michael J., 2004, Determinants of innovative activity in Japanese technology-based start-up firms. *International Small Business Journal*, 22, 159-96.

Malerba, Franco and Torrisi, Salvatore, 1992, Internal capabilities and external networks in innovative activities. Evidence from the software industry. *Economics of Innovation and New Technologies*, 2:49-71.

Moulaert, Frank and Sekia, Farid, 2003, Territorial innovation models: a critical survey. *Regional Studies*, 37:289-302.

Nelson, Richard R. and Winter, Sidney G., 1982, *An evolutionary theory of economic change.* Cambridge: Harvard University Press.

Oerlemans, Leon A.G., Meeus, Marius T., 2005, Do organizational and spatial proximity impact on firm performance? In: *Regional Studies*, 39, 89-104.

Pittaway, Luke, Robertson, Maxime, Munir, Kamal and Denyer, David, 2004, Networking and innovation: A systematic review of the evidence. *Lancaster University Management School, Working Paper 2004/016.*

Rogers, Mark, 2004, Networks, firm size and innovation. *Small Business Economics*, 22, 141-153.

Schumpeter, Josef A., 1942, *Capitalism, socialism and democracy.* New York: Harper and Row.

Shane, Scott, 2000, Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science*, 11, 448-69.

Shane, Scott and Katila, Riitta, 2003, When are new firms more innovative than established firms? *Robert H. Smith School of Business Working Paper,* University of Maryland.

Sirili, Giorgio and Evangelista, Rinaldo, 1998, Technological innovation in services and manufacturing: results from Italian surveys. *Research Policy*, 27, 881-99.

Sternberg, Rolf, 1999, Innovative linkages and proximity: empirical results from recent surveys of small and medium sized firms in German regions. *Regional Studies*, 33, 529-40.

Strambach, Simone, 2002, Change in the innovation process: new knowledge production and competitive cities – the case of Stuttgart. *European Planning Studies*, 10, 214-31.

Sundbo, Jon and Gallouj, Faïz, 1998, Innovation in services, *SI4S Synthesis Papers S2*. Oslo: STEP Group.

Tether, Bruce S., 2003, The sources and aims of innovation in services: variety between and within sectors. *Economics of Innovation and New Technologies*, 12, 481-505.

Tödtling, Franz and Kaufmann, Alexander, 2001, The role of the region for innovation activities of SMEs. *European Urban and Regional Studies*, 8, 203-15.

Witt, Peter, 2004, Entrepreneurs' networks and the success of start-ups. *Entrepreneurship & Regional Development*, 16, 391-412.

ZEW – Centre for European Economic Research, 2004, *ZEW Gründungsreport.* Mannheim, ZEW.

11 THE EVOLUTION OF REGIONAL ENTREPRENEURSHIP AND GROWTH REGIMES

Michael Fritsch and Pamela Mueller

1. The Problem

It is hardly disputed that new business formation and self-employment can be important drivers of economic growth (Scarpetta, 2003; Carree and Thurik, 2003). Recent empirical studies (Fritsch and Mueller, 2004; Van Stel and Storey, 2004; Baptista, Escária and Madrugo, 2005) have clearly shown that the main positive effects of new business formation do not occur immediately when the new ventures are started but become effective only in the longer run. This paper analyzes the development of regional entrepreneurship and its effect on employment growth in West Germany in the 1983-2002 period. First, we investigate the magnitude and persistence of regional entrepreneurship (section 3 and 4). The second part is devoted to the impact of new businesses on regional employment. This analysis is based on a classification of regional growth regimes that are identified according to differences in the effect that entrepreneurship has on regional employment growth (section 5). In investigating transitions between growth regimes we are able to identify a typical life-cycle of regime types that has important implications for a policy that is aiming at stimulating regional development (section 6). We begin with some basic information on the data and on measurement issues (section 2).

2. Data and Measurement Issues

Our information on new firm formation and regional employment is from the establishment file of the German Social Insurance Statistics, as described and documented by Fritsch and Brixy (2004). This database provides information about all establishments that have at least one employee subject to obligatory social insurance. The information on West Germany is currently available on a yearly basis for a relatively long time period of twenty years ranging from 1983 to 2002.

Because the database records only businesses[1] with at least one employee, start-ups consisting of only owners are not included. In order to capture regional entrepreneurship, we exclude new businesses with more than twenty employees in the first year of their existence. As a result, a considerable number of new subsidiaries of large firms contained in the database are not counted as start-ups.[2] Although the database only includes information at the establishment level, a comparison with information on the regional distribution of headquarters of newly founded firms reveals a rather high correlation. Therefore, our information on new businesses can be regarded as indicator for regional entrepreneurship (see Fritsch and Brixy, 2004, and the analyses in Fritsch and Grotz, 2002). The share of employees in young and small firms or the share of young and small firms in the respective regions could also be utilized as a measure of regional entrepreneurship. According to Wagner (2004) work experience in young and small firms has a positive impact on the propensity to be a nascent entrepreneur. Moreover, Mueller (2005) found that a high share of small and young firms in the region can be regarded as a breeding ground for nascent entrepreneurs. Therefore, a high share of young and small firm may be a good indicator of a well-developed entrepreneurial climate or entrepreneurial spirit in a region.

We restrict our analysis to West Germany because many empirical studies indicate that the East German economy in the 1990s was a special case with very specific conditions that cannot be directly compared to those of West Germany (cf. Brixy and Grotz, 2004; Fritsch, 2004; Fritsch and Grotz, 2004).[3] The 74 West German planning regions form the spatial framework of the analysis. Planning regions are functional units that consist of at least one core city and the surrounding area (see BBR, 2003). They are somewhat larger than what is frequently defined as labor market area.

The sheer number of start-ups that occur in a region within a certain time period is only of limited significance for an interregional comparison because

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1 We use the term 'new businesses' as the overall category for both new firm headquarters and new subsidiaries. Our empirical data include these two categories of new entities. For an analysis at the regional level, there are important differences between new firms and new establishments. One of these differences relates to the location of entrepreneurship. While both the set-up of new firms as well the set-up of subsidiary establishments involves some entrepreneurship, this entrepreneurship will be mainly sited at the firm's headquarters. The creation of a new branch plant in a region may, therefore, not be regarded as an indication for entrepreneurship there. Moreover, the location decision for a subsidiary could be influenced by factors that are rather different from those that determine the location of a new firm's headquarter. Restricting the empirical analysis to the firm level by including only new headquarters could make largely sure that the focus is on the effect of entrepreneurship. A potential disadvantage of such an analysis could be that it neglects the important effect that new branch plants may have for regional development.

2 The share of new establishments with more than 20 employees in the first year in the data is rather small (about 2.5 percent). Applying a definition without a size-limit does not lead to any significant changes of the results.

3 The Berlin region was excluded due to changes in the definition of that region during the time period under inspection.

it does not account for the economic potentials of these regions. In order to judge if the level of start-up activity in a certain region is relatively high or relatively low compared to other regions, or if some regions are more entrepreneurial than other regions, the number of start-ups should be related to the economic potential of the respective region. For this purpose, a start-up rate has to be determined. There are a number of alternative ways to calculate such a start-up rate.[4] We use the start-up rate according to the labor market approach. This means that 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, including those persons that are recorded as unemployed. This kind of start-up rate is based on the notion that each member of the workforce is faced with the decision to work as a dependent employee in someone else's business or to start his or her own firm. Because start-ups are usually closely located to the founder's residence (Gudgin, 1978; Mueller and Morgan, 1962; Cooper and Dunkelberg, 1987), the regional workforce can be regarded as an appropriate measure of the number of potential entrepreneurs. The entry rate according to the labor market approach may be interpreted as the propensity of a member of the regional workforce to start an own business.

3. Regional Differences of Entrepreneurship over Time

During the 1983-2002 period there were on average about 126,000 private sector start-ups per year in West Germany. Over the years the number of start-ups increased slightly with a relatively distinct rise between the years 1990 and 1991 and between 1997 and 1999.[5] The difference between the average number of new businesses in the 1983-89 and the 1990-97 period was about 12.3 percent, and the difference between the average number of start-ups in the 1990-1997 and the 1998-2002 period was about 16.6 percent. The majority of the new businesses, about 93,400 per year (74 percent of all start-ups), were in the service sector compared to about 13,800 new establishments per year (11 percent of all start-ups) in manufacturing.[6] There was an overall trend towards an increasing share of start-ups in the service sector and a corresponding decreasing share of new businesses in manufacturing (figure 11.1). In the service sector, the largest number of new establishments was set up in wholesale and resale trade, hotels and inns, and the non-

4 See Audretsch and Fritsch (1994) for different approaches of calculating start-up rates.

5 The reasons for these two increases are largely unclear. It would not be very implausible to suspect that the rise of the number of start-ups between 1990 and 1991 was caused by the unification of East and West Germany in the year 1990. However, we could not find any further indication for this hypothesis in the data. The rise between 1997 and 1999 coincides with a change of the sector classification system of the Social Insurance Statistics, but again, it remains unclear how this change could have affected the number of start-ups that was recorded.

6 The other private sectors are agriculture and forestry, fishery, energy and water supply, mining and construction.

specified other services. In manufacturing, most start-ups were in electrical engineering, furniture, and food.

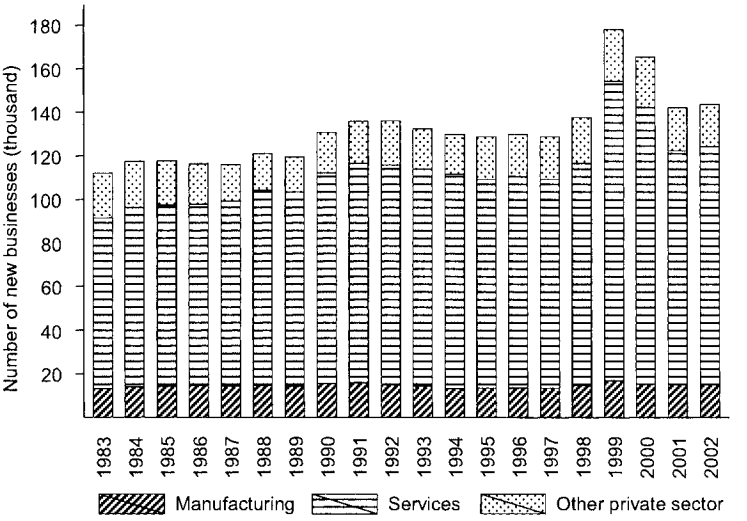


Figure 11.1: Number of start-ups per year in West Germany 1983-2002

Not surprisingly, most of the start-ups between 1983 and 2002 (on average 56.34 percent) were located in the densely populated agglomerations, while only on average 11.27 percent were in rural areas. The share of new businesses in the service sector was relatively high in agglomerations (77.02 percent) and lowest in rural regions (68.59 percent). Taking the private sector as a whole, we find the highest start-up rates in rural areas (7.78), but the start-up rate in agglomerations is not much lower having an average value of 6.88. The highest start-up rates in manufacturing can be found in the moderately congested regions and in agglomerations, the highest start-up rates for services are in rural areas as well as in agglomerations. Despite these differences however, the regional distribution of start-up rates in the two sectors is rather similar to the picture that we get for the overall private sector (figure 11.2).[7] Generally, start-up rates tended to be higher in the northern part of West Germany and in the regions south of Munich and Cologne.

The regional distribution of the share of employees in young and small firms, namely firms that are at maximum three years old, shows a very similar picture. While in and south of Munich almost eight percent of all employees were working in small and young businesses this share is only about five percent in the Stuttgart region. The regions in the northern part of Germany are also characterized by a high share of employees in young and small firms that amounts to about nine percent.

7 Start-up rates can be estimated for the time period 1984-2002. Due to missing data on regional unemployment in the year 1983, start-up rates for the year 1983 cannot be calculated.

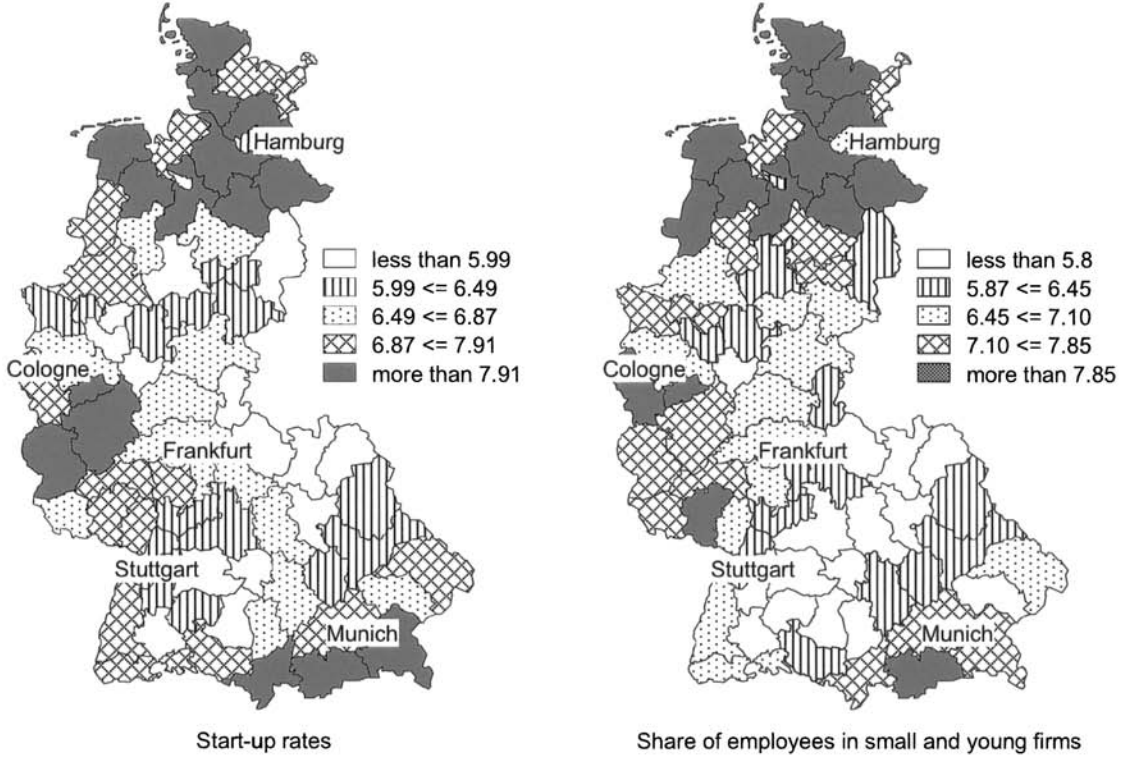


Figure 11.2: Average start-up rates (1984-2002) and average share of employees in small and young firms (1987-2002)

The development of the number of start-ups is rather steady, not only for the West German economy as a whole but also at the level of planning regions (figure 11.3). We use start-up rates for comparison of the level of new business formation activity between regions. Investigating the relationship between regional start-up rates (number of new businesses per 1,000 persons in the workforce) in different years shows rather high correlation (figure 11.3 and table 11.A1 in the Appendix). In most cases the correlation coefficient of start-up rates in subsequent years assumes a value between 0.96 and 0.98. The relationship is somewhat less close for years that are farther apart, but even over a ten, 15 and 19 year period the value of the correlation coefficient always remains above 0.76. There is some slight variation with regard to the strength of this relationship between the different years, but the basic pattern remains remarkably constant. Obviously, new business formation activity is rather persistent over time.

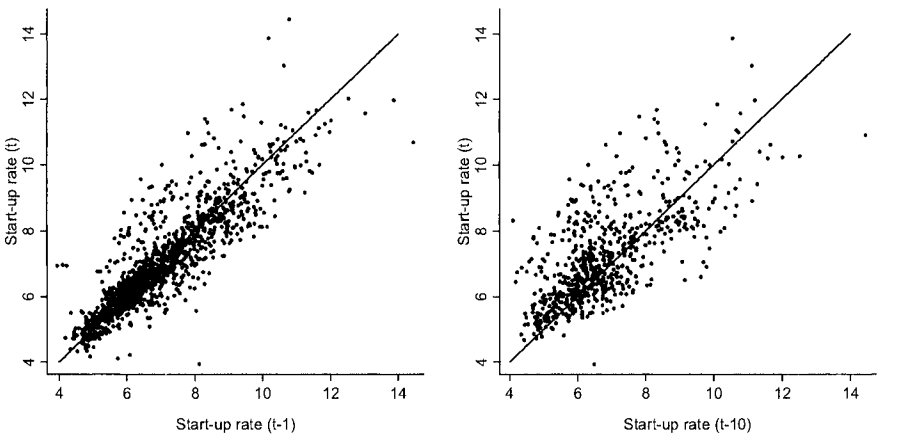


Figure 11.3: Relationship between start-up rates in subsequent years (t and t-1) and over a ten year period (t and t-10)

In comparison to the pronounced persistency of start-up rates over time, we find a high variation between start-up rates across space. The minimum regional start-up rate is about 4 start-ups per 1,000 persons in the regional work force while the maximum start-up rate amounts to a little more than 14 (figure 11.3). The variation of start-up rates over time may be caused by either changes in the number of start-ups (the numerator of the start-up rate) or by changes in the regional workforce (the denominator). Fritsch and Mueller (2005c) find that changes of start-up rates are mainly a result of the variation of the new business formation activity, while the effect of changes of the number of employees is more or less negligible.

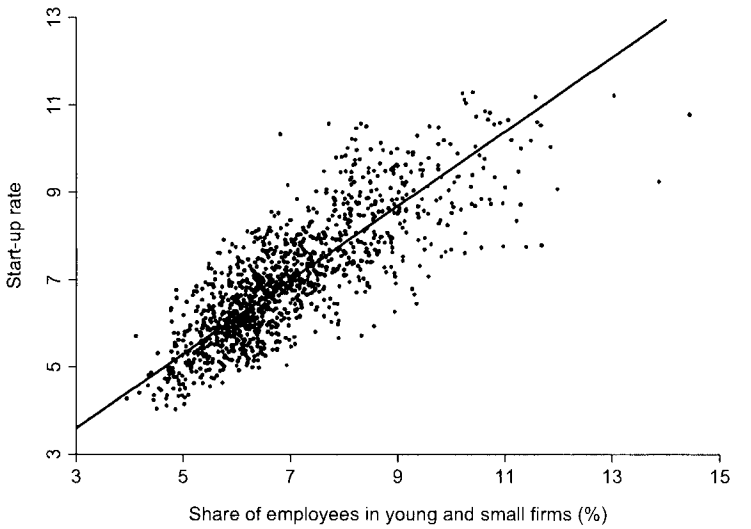


Figure 11.4: Relationship between the share of employees in young and small firms and new business formation rates West Germany 1987-2002

There seems to be an overall trend that those regions that have a high share of employees in small and young firms also experience a high level of new business formation activity (cf. figure 11.4).[8] This finding confirms the results of Wagner (2004) and Mueller (2005), who found that young and small firms are hothouses for nascent entrepreneurs (also Beesley and Hamilton, 1984). Thus, we conclude that a high share of employees in young and small firms characterizes a breeding ground for new business formation in the region.

4. Changes in Regional Entrepreneurship

Ordering regions by their start-up rate in ascending order gives their rank position with regard to the level of entrepreneurship. These rank positions of regions display their relative performance with regard to the respective indicator independent of the national trend. We assign rank 74 to the region with the highest value of the entrepreneurship indicator and rank 1 to the region with the lowest value. Because our interest is not in the short term fluctuations but rather in the development in the medium and the long run, we compare the changes of rank positions between five-year periods. Rank positions for the average start-up rates were calculated for the periods 1984-87 (period I), 1988-92 (period II), 1993-97 (period III), and 1998-2002 (period IV).

8 A comparison of regional start-up rates using the business stock approach and the share of young and small firms results in a similar picture. Regions with a high share of small and young firms also experience high start-up rates (beta coefficient of 0.80).

West German planning regions hardly experience a rank change with regard to their start-up rate of more than twenty positions between two successive five-year periods (table 11.1). The number of regions with rank changes of more than twenty positions increases with the length of the time period. Between period I and III (II and IV) five (six) regions change more than twenty rank positions. Between period I and IV such great changes can be found for nine regions, representing 12.16 percent of all regions. On average, less than half of the regions experienced a change of more than three rank positions between two successive time periods. In more than 85 percent of the regions changes between two successive time periods did not exceed ten rank positions. The greatest change between two successive periods amounted to 25 rank positions. Over three periods (period I → III or period II → IV) the maximum number of rank position change is 27 and 31, respectively. The maximum change over four periods (period I → IV) is 30 rank positions. In four out of the nine regions that experienced a change of more than twenty rank positions between period I and IV; this change was positive (Bayerischer Untermain/Aschaffenburg, Cologne, Hamburg, and Duesseldorf), in four cases it was negative (Emsland, Osnabrueck, Arnsberg, and Landshut).

Table 11.1: Change of rank positions of start-up rates between five year periods

	Number of rank positions changed between period[+]							
	0	≤ 3	≤ 5	≤ 10	≤ 15	≤ 20	> 20	Maximum[++]
I → II	4 5.41	40 54.05	47 63.51	64 86.49	68 91.89	74 100.00	0 0.00	19 (46 → 27)
II → III	8 10.81	33 44.59	47 63.51	64 86.49	70 94.59	71 95.95	3 4.05	25 (21 → 46)
III → IV	10 13.51	41 55.41	53 71.62	66 89.19	69 93.24	74 100.00	0 0.00	20 (44 → 24) (32 → 12) (45 → 25)
I → III	3 4.05	25 33.78	33 44.59	57 77.03	65 87.84	69 93.24	5 6.76	27 (19 → 46)
II → IV	7 9.46	31 41.89	39 52.70	56 75.68	64 86.49	68 91.89	6 8.11	31 (51 → 20)
I → IV	1 1.35	17 22.97	30 40.54	50 67.57	56 75.68	65 87.84	9 12.16	30 (65 → 35) (50 → 20)

Time periods: I = 1984-87, II = 1988-92, III = 1993-97, IV = 1998-2002. [+] First row: number of regions; second row: share of all regions (percent); change of ranks in absolute numbers. [++] Last column: absolute number of ranks, rank positions in parentheses,
highest rank = rank 74.

In an analysis of the factors determining changes of regional new business formation activity Fritsch and Mueller (2005b) found that regional innovativeness and the share employment in small and young businesses are rather conducive to an increase of start-up rates. Generally, a high level of new business formation rates can be regarded as a seedbed for future entrepreneurial activities; thus, entrepreneurship is to a degree self-energizing.

5. Distribution and Transition of Regional Growth Regimes

Audretsch and Fritsch (2002) suggested that there may be considerable differences between regions with regard to the role that new firms and entrepreneurship play for development. In introducing a theory of regional growth regimes, they extended the concept of the technological regime (Audretsch, 1995, 39-64; Marsili, 2002; Winter, 1984) from the unit of observation of the industry to a geographic unit of observation (see also Fritsch, 2004). By analogy to the common concepts of a technological regime, the growth regime in a region is labeled *entrepreneurial* if growth results from a high level of new-firm start-ups and a turbulent enterprise structure. In contrast, regions where above average growth goes together with a relatively stable structure of large, incumbent enterprises are regarded as having a *routinized* growth regime. In the routinized regime, new businesses do not play an important role, and their chances for survival and growth are much lower than in an entrepreneurial regime.

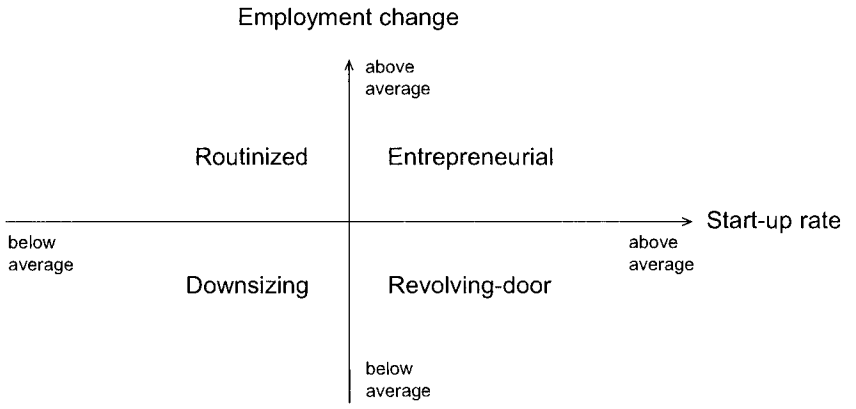


Figure 11.5: Growth regime types and their characteristics

Audretsch and Fritsch (2002) characterized regions which exhibit relatively low growth rates but above average start-up rates as *revolving-door* growth regimes (see also Fritsch and Mueller, 2005a). They suspected that under such a regime entries tend to be non-innovative, supplying basically the same products and using nearly the same technology as the incumbent firms.

Finally, relatively low-growth regions, which are characterized by a below average level of start-up activity, are classified as a *downsizing* growth regime. In such a region, the amount and the quality of start-ups is obviously not sufficient to provide enough new jobs or income to substitute for the losses in the incumbent firms.

Table 11.2: Distribution of growth regime types over time

	1984-1992	1988-1997	1993-2002
Number of planning regions classified as:			
Entrepreneurial	20	25	23
Routinized	17	12	14
Downsizing	20	25	23
Revolving-door	17	12	14
Entrepreneurial regime characteristics:			
Employment change (mean)	24.16	12.86	7.89
Start-up rate (mean)	7.96	8.16	7.39
Routinized regime characteristics:			
Employment change (mean)	21.63	9.99	4.33
Start-up rate (mean)	6.05	5.61	5.80
Downsizing regime characteristics:			
Employment change (mean)	12.33	0.75	-4.65
Start-up rate (mean)	5.67	5.58	5.53
Revolving-door regime characteristics:			
Employment change (mean)	14.51	1.02	-3.08
Start-up rate (mean)	8.42	6.93	7.45

We have assigned all 74 West German planning regions to these four growth regime types. This classification is based on the regional start-up rate and the percentage of employment change (cf. figure 11.5 and table 11.A2 in the appendix). Because the main part of the positive employment effects of new businesses occurs only in the longer run (Fritsch and Mueller, 2004; Van Stel and Storey, 2004; Baptista, Escária and Madrugo, 2005), it is important to relate the indicators for entrepreneurship to the growth performance of a sufficiently long time period. Fritsch and Mueller (2004) have found that West German regions which have the strongest positive effect of new business formation on regional employment occurred about seven to eight years after the new entities had been set up. In order to capture such long-term effects we choose three relatively long periods for the classification into regional growth regimes, namely the years 1984-1992, 1988-1997, and 1993-2002. For these three time periods the average start-up rate of the first two years is always linked to percentage of employment change of the whole

period. If both, the start-up rate and the employment growth rate, exceed their median values the regional growth regime is regarded as entrepreneurial. A routinized regime is characterized by a start-up rate below the median value and an employment growth rate exceeding the median. The downsizing regime is given when both rates are below the median values. Finally, a district is classified as a revolving-door regime if the start-up rate exceeds the median value but employment growth rate is below the median.

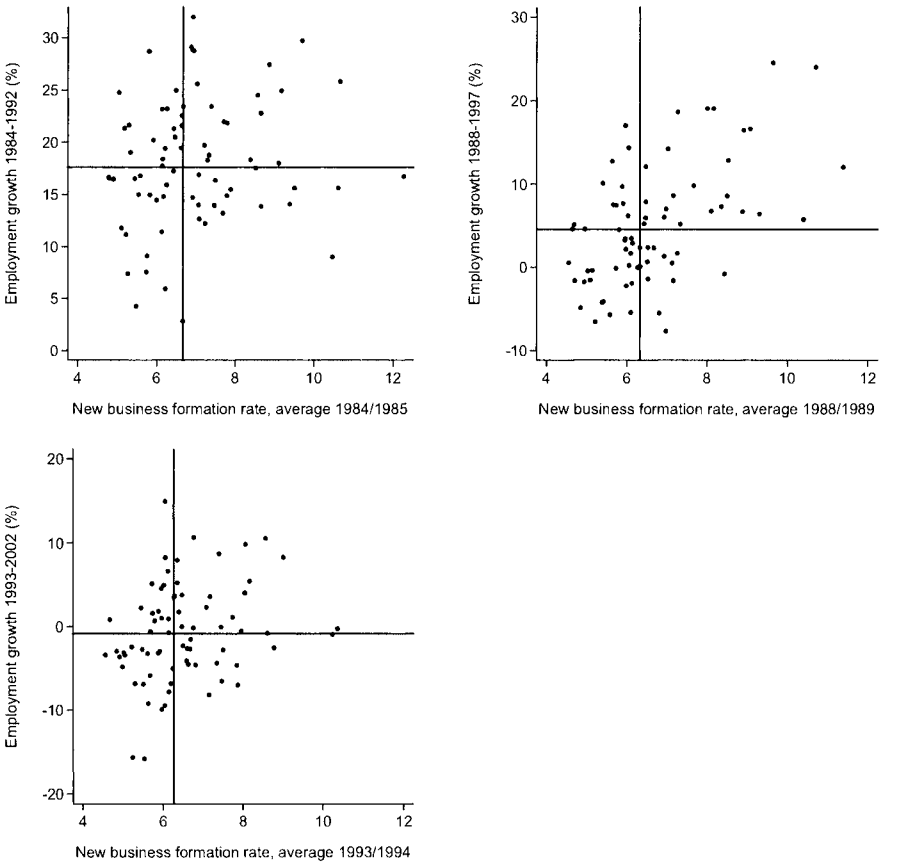


Figure 11.6: Distribution of growth regimes between 1984-1992, 1988-1997, and 1993-2002

The distribution of regions among the four categories of growth regimes shows that regions of a certain regime-type tend to be clustered in space (cf. table 11.2 and figure 11.6). This indicates the prevalence of neighborhood effects. Obviously, the spatial context is of relevance for the relationship between entrepreneurial activity and economic development (figure 11.7).

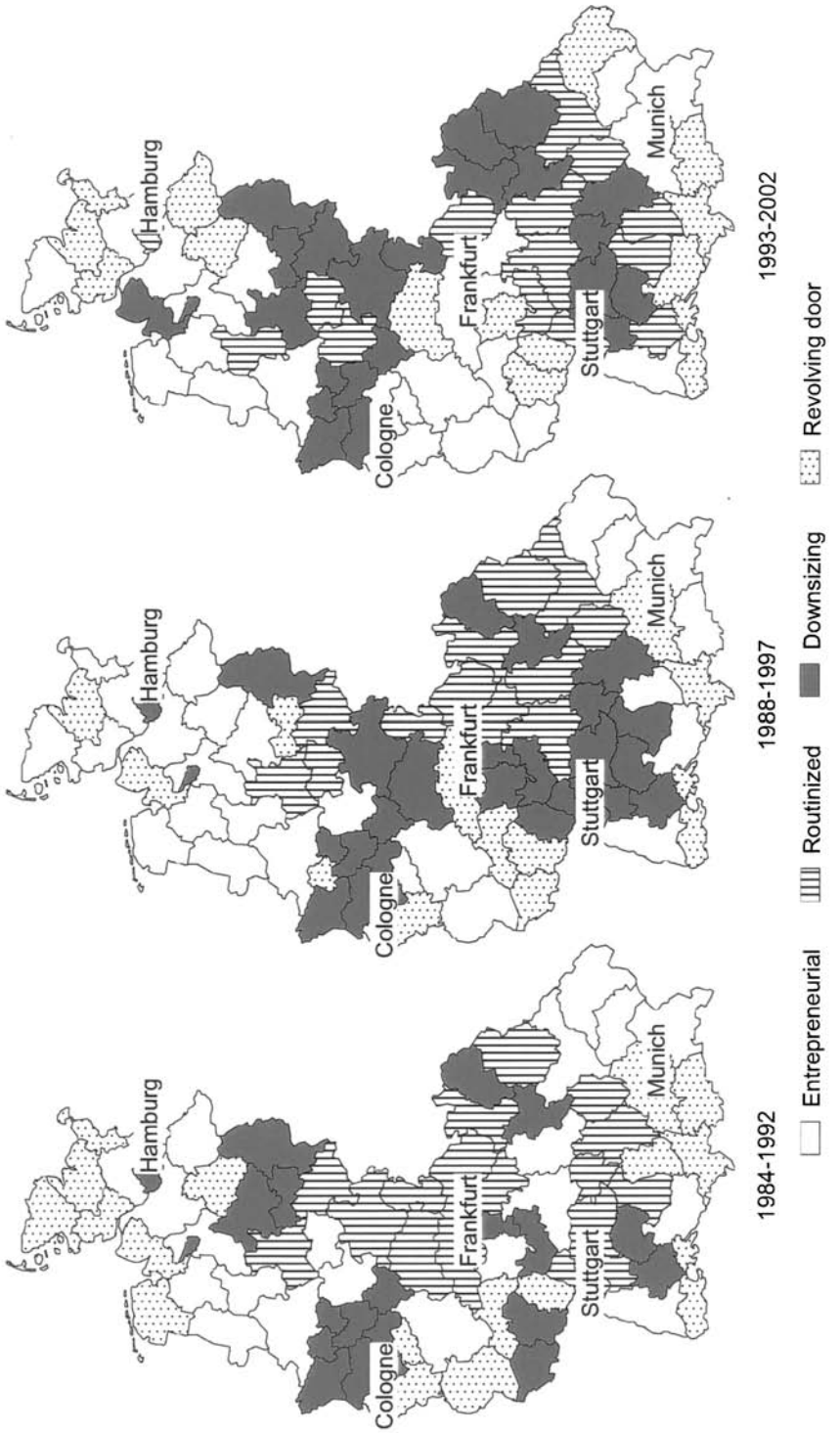


Figure 11.7: Types of regional growth regimes 1984-1992, 1988-1997, and 1993-2002

For the period of analysis, there is a remarkably prevalent transition from revolving-door regimes to entrepreneurial regimes in the northern part of Germany in the regions around Frankfurt as well as in the region of Munich. These regions have succeeded to transform new business formation into employment growth. The regions south of Cologne also became more and more entrepreneurial between 1984 and 2002. It is remarkable that particularly many of those regions that have been classified as routinized tend to become downsizing regimes in later periods, like regions around Stuttgart and northeast of Munich, or south of Hanover). Most of the regions categorized as entrepreneurial regimes over all three time periods are located in the north of Germany or in the southeast, and half of the regions that are classified as downsizing regimes for all three periods are clustered in the Rhine-Ruhr area north of Cologne.

Table11.3: Distribution of regions across regimes and transition probabilities between time periods

	Regime type in period 1988-97 and 1993-2002									
Regime type in period 1984-92, 1988-97	Entrepreneurial		Routinized		Downsizing		Revolving-door		Row Total	
	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%
Entrepreneurial regime	15	75.00	4	20.00	1	5.00	0	0.00	20	100
	15	60.00	3	12.00	0	0.00	7	28.00	25	100
		67.50		16.00		2.50		14.00		
Routinized regime	0	0.00	8	47.06	8	47.06	1	5.88	17	100
	1	8.33	7	58.33	4	33.33	0	0.00	12	100
		4.17		52.70		40.20		2.94		
Downsizing regime	1	5.00	0	0.00	15	75.00	4	20.00	20	100
	1	4.00	5	20.00	15	60.00	4	16.00	25	100
		4.50		10.00		67.50		18.00		
Revolving-door regime	9	52.94	0	0.00	1	5.88	7	41.18	17	100
	5	41.67	0	0.00	3	25.00	4	33.33	12	100
		47.31		0.00		15.44		37.26		
Column Total	25	33.78	12	16.22	25	33.78	12	16.22	74	100
	22	29.73	15	20.27	22	29.73	15	20.27	74	100

First row: change between 1984-92 and 1988-97, second row: change between 1988-97 and 1993-2002, third row: average transition probability.

Comparing all of the transitions together between the successive time periods, we found that on average 67.5 percent of the regions with an entrepreneurial regime stay in this category in the successive time period. The probability of remaining entrepreneurial is almost five-times higher than becoming a revolving-door regime and about four-times as high as becoming a routinized regime in the subsequent time period. Regions classified as a revolving-door regime have a higher probability of shifting towards an

entrepreneurial regime (47.3 percent) than remaining in the revolving-door category (37.3 percent) in the following period. Those regions that are assigned to the downsizing category show the same degree of persistence in this type of regime as the entrepreneurial regions. In the successive time period, 67.5 percent of these regions remain in the downsizing category. The probability of a region characterized by a downsizing regime to become routinized is much smaller (10 percent) than the probability of a region with a routinized regime to become a downsizing regime (40.2 percent). For both the routinized and downsizing regimes, we found the lowest probability to be a transition to an entrepreneurial regime (both about 4 percent). If regions characterized by a routinized or a downsizing regime succeed to overcome the low level of new firm formation activity, these regions are quite likely to first fall into the revolving-door category before they can, in later periods, benefit from the employment-generating effects of new firm formation and become entrepreneurial regimes (cf. table 11.3 and figure 11.8).

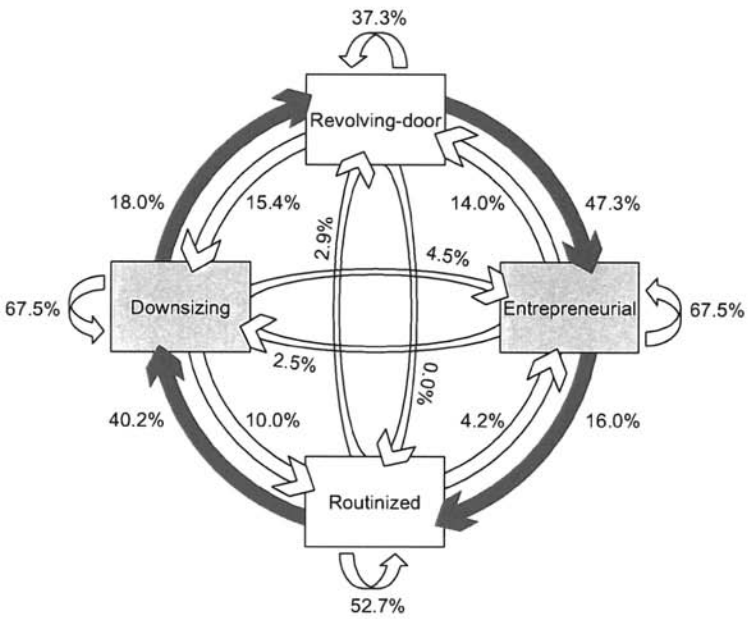


Figure 11.8: Transitions of growth regime types

Obviously, a typical development cycle for the regional growth regime can be identified. According to this typical development pattern it takes considerable time until a high level of start-up activity results in above-average growth. Therefore, the revolving-door regime leads the way of an entrepreneurial regime. Since an entrepreneurial regime which is characterized by an above-average level of new business formation and economic growth is the most likely development stage following a revolving door regime suggests that the positive effects of start-ups last somewhat

longer than the ten year period that was found in the analysis of Fritsch and Mueller (2004). If the regional level of new business formation falls below the average growth rates may still be relatively high for some time. However, soon these late benefits of earlier start-up activity will fade away and the region becomes a downsizing regime. In this situation regional growth can be revitalized by means of increasing new business formation activity, which appears to be of crucial importance for securing long term economic prosperity in a region.

6. Conclusions

We found considerable differences of regional start-up rates and it is quite likely that these differences have consequences for regional development, albeit in the long run. The level of regional new business formation activity shows a pronounced path dependency and persistence over time. Regions with relatively high rates of new business formation in the past are likely to experience a correspondingly high level of start-ups in the future. Accordingly, regions with a low level of new businesses today can be expected to have only relatively few start-ups in the near future. As far as changes in the level of regional start-up activity do occur, they emerge over quite a long period of time, and in most cases they are rather small. This high degree of persistence suggests that there are only weak prospects for rapid change with regard to regional new business formation activity. Therefore, a policy that is aiming at stimulating the regional level of entrepreneurship needs patience and a long-term orientation.

Patience and long-term orientation are also needed with regard to the growth-enhancing effects of new business formation. Our analysis of the transition of regional growth regimes suggests that these effects occur only in the long run and that the relevant time-lags may be even longer than what was found in the analyses of Fritsch and Mueller (2004), van Stel and Storey (2004) and Baptista, Escária and Madrugo (2005). We found typical transitions between the different types of growth regimes that do suggest some kind of life-cycle approach to regional development with regard to new firm formation; namely from revolving-door to entrepreneurial to routinized to downsizing.

Our analysis shows that some regions succeeded in considerably increasing the level of entrepreneurship during the period under inspection. However, in other regions start-up rates are fairly constant over a long period of time. This leads us to the question of what are the most promising ways of stimulating regional entrepreneurship? Fritsch and Mueller (2005b) found that innovation activities and the entrepreneurial climate play a crucial role in this respect. This suggests that innovation and entrepreneurial climate could serve as appropriate starting points for a policy that aims at promoting regional

entrepreneurship. Further research should try to identify suitable instruments of such a policy.

References

Audretsch, David B., 1995, *Innovation and Industry Evolution*. Cambridge: MIT Press.

Audretsch, David B. and Michael Fritsch, 1994, On the Measurement of Entry Rates. *Empirica*, 21, 105-113.

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

Baptista, Rui, Victor Escária and Paulo Madrugo, 2005, *Entrepreneurship, Regional Development and Job Creation: the Case of Portugal*. Papers on Entrepreneurship, Growth and Public Policy 06-2005, Max-Planck Institute for Economics, Jena, Germany.

Bundesamt für Bauwesen und Raumordnung (BBR), 2003, *Aktuelle Daten zur Entwicklung der Städte, Kreise und Gemeinden*, Band 17. Bonn.

Beesley, Michael Edwin and Robert T. Hamilton, 1984, Small firms' seedbed role and the concept of turbulence. *Journal of Industrial Economics*, 33, 217-231.

Brixy, Udo and Reinhold Grotz, 2004, Differences of the economic performance of newly founded firms in West- and East Germany. In: Michael Dowling, Jürgen Schmude and Dodo zu Knyphausen-Aufsess (Eds.), *Advances in Interdisciplinary European Entrepreneurship Research*. Muenster: Lit, 143-152.

Carree, Martin A. and A. Roy Thurik, 2003, The Impact of Entrepreneurship on Economic Growth. In: Zoltan A. Acs and David B. Audretsch (Eds.), *Handbook of Entrepreneurship Research*. Boston: Kluwer, 437-471.

Cooper, Arnold and William C. Dunkelberg, 1987,, Entrepreneurial Research: Old Questions, New Answers and Methodological Issues. *American Journal of Small Business*, 11, 11-23.

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

Fritsch, Michael and Reinhold Grotz, 2002, *Das Gründungsgeschehen in Deutschland - Darstellung und Vergleich der Datenquellen (New Firm Formation in Germany – Exposition and Comparison of Data Sources)*. Heidelberg: Physica.

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

Fritsch. Michael and Reinhold Grotz, 2004, *Empirische Analysen des Gründungsgeschehens in Deutschland (Empirical Analyses of New Firm Formation Processes in Germany)*. Heidelberg: Physica.

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, 2005a, Regional Growth Regimes Revisited, – The Case of West Germany. In: Michael Dowling, Jürgen Schmude and Dodo von Knyphausen-Aufsess (Eds.), *Advances in Interdisciplinary European Entrepreneurship Research,* Vol. II, Muenster: Lit, 251-273.

Fritsch, Michael and Pamela Mueller, 2005b, How Persistent are Regional Start-up Rates? An Empirical Analysis. In: Vining, G.T. and R.C.W. van der Voort (Eds.), *The Emergence of Entrepreneurial Economics.* Amsterdam: Elsevier Science (forthcoming).

Fritsch, Michael and Pamela Mueller, 2005c, *The Persistence of Regional New Business Formation-Activity over Time – Assessing the Potential of Policy Promotion Programs*, Paper on Entrepreneurship, Growth and Public Policy, 02/2005, Max Planck Institute of Economics, Jena.

Gudgin, Graham, 1978, *Industrial Location Processes and Regional Employment Growth.* Westmead: Saxon House.

Marsili, Orietta (2002): Technological Regimes and Sources of Entrepreneurship. *Small Business Economics*, 19, 217-215.

Mueller, Eva and James N. Morgan, 1962, Location Decisions of Manufacturers. *American Economic Review*, 52, 204-217.

Mueller, Pamela, 2005, *Entrepreneurship in the Region: Breeding Ground for Nascent Entrepreneurs?* Working Paper 05/2005, Faculty of Economics and Business Administration, Technical Universiy Freiberg.

Scarpetta, Stefano, 2003, *The Sources of Economic Growth in OECD Countries.* Paris: OECD.

Van Stel, Andre and David Storey, 2004, The Link Between Firm Births and Job Creation: Is there a Upas Tree Effect? *Regional Studies*, 38, 893-909.

Wagner, Joachim, 2004, Are Young and Small Firms Hothouses for Nascent Entrepreneurs? *Applied Economics Quarterly*, 55.

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

Appendix

Table 11.A1: Correlation matrix of yearly start-up rates 1984-2002

	Start-up rate of year																	
	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985
2001	0.92																	
2000	0.96	0.92																
1999	0.93	0.90	0.97															
1998	0.94	0.89	0.94	0.94														
1997	0.95	0.92	0.95	0.93	0.95													
1996	0.95	0.91	0.96	0.95	0.96	0.96												
1995	0.92	0.88	0.92	0.93	0.95	0.95	0.97											
1994	0.91	0.88	0.92	0.93	0.95	0.95	0.96	0.98										
1993	0.92	0.89	0.93	0.94	0.94	0.96	0.96	0.97	0.97									
1992	0.82	0.88	0.92	0.92	0.95	0.95	0.95	0.96	0.95	0.96								
1991	0.90	0.86	0.89	0.89	0.93	0.92	0.93	0.94	0.93	0.94	0.95							
1990	0.86	0.82	0.88	0.86	0.89	0.90	0.90	0.92	0.91	0.93	0.96	0.91						
1989	0.90	0.86	0.90	0.90	0.93	0.92	0.93	0.93	0.93	0.94	0.97	0.95	0.95					
1988	0.88	0.82	0.86	0.85	0.90	0.88	0.89	0.88	0.88	0.89	0.95	0.93	0.91	0.96				
1987	0.87	0.84	0.88	0.87	0.92	0.90	0.91	0.92	0.91	0.92	0.96	0.94	0.93	0.97	0.95			
1986	0.81	0.76	0.81	0.81	0.88	0.84	0.86	0.88	0.86	0.86	0.92	0.88	0.92	0.94	0.92	0.95		
1985	0.82	0.79	0.84	0.84	0.89	0.87	0.88	0.91	0.90	0.89	0.95	0.91	0.93	0.95	0.92	0.96	0.96	
1984	0.84	0.80	0.86	0.87	0.91	0.88	0.90	0.93	0.91	0.91	0.94	0.92	0.90	0.94	0.89	0.95	0.93	0.97

All coefficients significant at 1%-level.

Table 11.A2: Growth regime types

name of planning region	number of region	1984-1992	1988-1997	1993-2002
Schleswig-Holstein Nord	1	RD	E	E
Schleswig-Holstein Sued-West	2	RD	E	RD
Schleswig-Holstein Mitte	3	RD	RD	RD
Sshleswig-Holstein Ost	4	RD	E	RD
Schleswig-Holstein Sued	5	E	E	E
Hamburg	6	D	D	R
Bremen	11	D	D	D
Ost-Friesland	12	RD	E	E
Bremerhaven	13	RD	RD	D
Hamburg-Umland-Sued	14	E	E	E
Bremen-Umland	15	E	E	E
Oldenburg	16	E	E	E
Emsland	17	E	E	E
Osnabrueck	18	E	E	R
Hannover	19	D	E	E
Suedheide	20	RD	E	RD
Lueneburg	21	E	E	RD
Braunschweig	22	D	D	D
Hildesheim	23	D	RD	D
Goettingen	24	R	R	D
Muenster	35	E	E	E
Bielefeld	36	R	R	D
Paderborn	37	E	R	R
Arnsberg	38	E	E	R
Dortmund	39	D	D	D
Emscher-Lippe	40	D	RD	D
Duisburg/Essen	41	D	D	D
Duesseldorf	42	D	D	D
Bochum/Hagen	43	D	D	D
Koeln	44	D	D	E
Aachen	45	RD	RD	E
Bonn	46	RD	E	E
Siegen	47	D	D	D
Nordhessen	48	R	D	D
Mittelhessen	49	R	D	RD
Osthessen	50	R	R	D
Rhein-Main	51	R	RD	E
Starkenburg	52	E	D	RD
Mittelrhein-Westerwald	62	E	E	E
Trier	63	RD	E	E

Continuation *table 11.A2*:

name of planning region	number of region	1984-1992	1988-1997	1993-2002
Rheinhessen-Nahe	64	RD	RD	E
Westpfalz	65	D	RD	RD
Rheinpfalz	66	RD	D	RD
Saar	67	D	RD	E
Unterer Neckar	68	D	D	R
Franken	69	E	R	R
Mittlerer Oberrhein	70	R	D	R
Nordschwarzwald	71	R	D	D
Stuttgart	72	R	D	D
Ostwuerttemberg	73	R	D	D
Donau-Iller (Ba-Wü)	74	R	D	R
Neckar-Alb	75	D	D	D
Schwarzwald-Baar-Heuberg	76	D	D	R
Südlicher Oberrhein	77	E	E	E
Hochrhein-Bodensee	78	RD	RD	RD
Bodensee-Oberschwaben	79	E	E	RD
Bayerischer Untermain	80	D	D	E
Wuerzburg	81	R	R	E
Main-Rhoen	82	R	R	R
Oberfranken-West	83	R	R	D
Oberfranken-Ost	84	D	D	D
Oberpfalz-Nord	85	R	R	D
Industrieregion Mittelfranken	86	D	D	D
Westmittelfranken	87	E	R	R
Augsburg	88	R	D	D
Ingolstadt	89	R	R	R
Regensburg	90	E	R	R
Donau-Wald	91	E	E	RD
Landshut	92	E	E	E
Muenchen	93	RD	RD	E
Donau-Iller (BY)	94	RD	E	R
Allgaeu	95	RD	RD	RD
Oberland	96	RD	E	RD
Suedostoberbayern	97	E	E	E

E = Entrepreneurial, R = Routinized, D = Downsizing, RD = Revolving door.

12 REGIONAL DIFFERENCES IN ENTREPRENEURSHIP EDUCATION

Perceptions of University Target Groups

Kerstin Wagner, Frank Bau, Jürgen Schmude and Michael Dowling

1. Introduction

One of the major problems still faced by entrepreneurship scholars in their field is the difficulty of creating a conceptual framework, integrating entrepreneurship theory-development into a coherent scheme. The discussion of what entrepreneurship research is about has been conducted by numerous authors (e.g. Busenitz et al., 2003; Bygrave and Hofer, 1991; Davidsson and Wiklund, 2001; Gartner, 2001; Low and MacMillan, 1988; Shane and Venkataraman, 2000). There is consensus that entrepreneurship research can include the creation and development of new organizations. However, this is not sufficient, because entrepreneurship can also happen within existing organizations or, furthermore, opportunities can be sold to other individuals or to existing organizations (Shane and Venkataraman, 2000, 219).

A broader definition of entrepreneurship can be explained by the fact that different approaches stem from different disciplines and influence the discussion of its legitimacy and how it is taught. Though the connection between research and education is a necessary precondition for establishing a field, and traditionally happens within one discipline, entrepreneurship research and teaching are often performed separately, and transfer of findings into education and training is often neglected. While research on different aspects of entrepreneurship is conducted in different disciplines, such as economics, business, geography, sociology, etc., teaching mainly takes place within the scope of business curricula. The result is that courses offered do not reach other disciplines and only focus on limited possible target groups. In contrast, a high number of potential nascent entrepreneurs are likely to be found in technology and knowledge-intensive subjects such as natural sciences, computer sciences or engineering.

The question of whether instructors are able to close the gaps between research and education, and between different target groups mostly depends on very different types of implementation of entrepreneurship education and

support in universities and regions. Each network structure consists of trainers, supervisors, and consultants and focuses on different objective targets in order to support students' intentions to set up a new venture. Regional differences are expressed in a different way to gain access to students from different faculties, and to implement content for entrepreneurship courses.

In this paper, we contribute to the literature by empirically investigating certain important issues related to the activities and perception of entrepreneurship education:

- Do the intentions and the perceptions in regard to being an entrepreneur differ between regions, or even between faculties?
- Do regional differences in education structures affect different needs and preferences concerning content?
- Which target groups perceive which activities as most important?

This study is based on the demand side of entrepreneurship education, course participants in particular, and students in general.

First, we describe the conceptual context of the topic, consisting of a brief description of the educational structures, status-quo and best practice of university entrepreneurship education in Germany including which possible target groups to address. Second, we outline the selected research areas and the research design. Third, we present the results divided into three sections: 1) students' entrepreneurial orientation, and 2) the perceptions of entrepreneurship per faculty and 3) motivations to participate in courses, and course-related results. We end with a brief discussion and set of conclusions.

2. Status-Quo of Entrepreneurship Education

2.1 Conceptual Context

The fact that there is a lack of theoretical rigor in the field of entrepreneurship, and that theoretical approaches are rooted in other domains, has a strong impact on course design. Courses do not emphasize a certain domain, and the quality of the textbooks used is frequently criticized. Also, professional qualifications are often discussed, because no clear standard exists as yet. Professors can be academic or corporately oriented, and both orientations are supported and criticized (e.g. Anderseck, 2004, 299; Fiet, 2000, 4; Heil, 2002, 72; Pinkwart, 2000, 199). Diverse academic backgrounds guide the course design and dictate the contents according to their own opinion. A limited and personal view of the topic and a lack of entrepreneurial experience could limit the scope of what entrepreneurship is.

Entrepreneurship textbooks also cause some disagreement concerning reasonable application in courses. Results of a review of several German und US entrepreneurship textbooks show that books do not yet meet the quality of

those in other fields of business administration (Bronner et al., 2001, 581). This fact could also be affected by the lack of theoretical content in the field. Most books show a high level of practical experience, mostly formulated as a recipe and not as rules according to which events occur (Fiet, 2000, 10). However, the longer tradition of entrepreneurship education and training in the US can be seen in the broader approach of the contents and a better didactical composition in textbooks, although education and research are still unconnected to each other. Empirical results published in accredited entrepreneurship journals (e.g. Journal of Business Venturing, Journal of Small Business Management) often are not included in textbooks (Bronner, et al. 2001, 598). A lack of theoretical content may result in entrepreneurship courses having the reputation of being more superficial than courses in other fields of business administration.

Lack of theoretical content also has a strong effect on the syllabus design, causing it to be filled with other contents. One common practice is using entrepreneurs as guest speakers with the intent of teaching students what they should do to be successful (Fiet, 2000, 9). As is well known, empirical results show that new firms have higher death rates than old ones, while the death risk of a firm sharply declines with age ("liability of newness and adolescence") (Brüderl and Schüssler, 1990, 530ff). Due to the high failure rate among nascent entrepreneurs, it is strongly inadvisable to adopt one's entrepreneurial experience and generalize experience to fit with students' situations. Studying the behavior of a (still) successful entrepreneur must assume that potential nascent student-entrepreneurs will face the same set of circumstances as the entrepreneur, without taking mediating factors such as luck or bias into account (Anderseck, 2004, 299; Fiet, 2000, 9).

Important aspects regarding the legitimacy of a young, still evolving field are the effects and the success of entrepreneurship education and training. A measurement that only focuses on the number of new ventures created is often criticized (Fallgatter, 2004, 40; Schmude and Uebelacker, 2002, 43). According to a broad range of definitions and perspectives of entrepreneurship and different understandings of being entrepreneurial (e.g. Shane & Venkataraman, 2000; Gartner, 2001; Davidsson, 2003), a purely output-approach in terms of new ventures is unjustifiable and ignores the fact that entrepreneurship education also deals with a broad range of infrastructures and environments (e.g. incubators, venture capitalists, public and private consultancies). Former students of entrepreneurship education programs could also fill positions within entrepreneurial infrastructures. Education and training also improve the image of entrepreneurship in society. Thus, it is not sufficient to count the number of new ventures or the number of participants in a course. Measurements should instead include the change in entrepreneurial intention and orientation, the participation in any kind of entrepreneurial activity, or at least the creation of a new venture or the achievement of personal career goals at a certain point after graduation. The conclusion is that various target groups

for entrepreneurship programs must be taken into account, and not just those who might start up a business.

2.2 Entrepreneurship Education in Germany

By the end of the 1990s, Katz (2003) counts more than 200 positions and about 1.400 courses offered in the USA (Katz, 2003, 291). While entrepreneurship as an academic field of research and teaching has developed rapidly in the US since the first entrepreneurship activities at Harvard Business School in 1947, situation in Germany is quite different to the US and initiated lately. Even if entrepreneurship education is meanwhile a central issue at the beginning of the new millennium in Germany, there are but few guidelines how to integrate contents in the University educational system.

Initial sporadic entrepreneurship education was started at University of Stuttgart and University of Cologne in the mid 1970 when courses for entrepreneurship were offered, also at the University of Dortmund the institute for entrepreneurship and organization research (bifego) started offering courses in the mid 1980 (Wöllner, 1991). University landscape has changed in terms of entrepreneurship education in 1990s as the idea of the chairs of entrepreneurship (*Gründungslehrstühle*) came up. The actual assignment of chairs for entrepreneurship has started then since 1998. This year as a starting point marks the subsequent creation of entrepreneurship chairs at Universities as well as at Universities of applied sciences (*Fachhochschulen*). Difficulties with the occupation of the chairs are still at present due to a young field of education and the absence of adequate profiles of skilled candidates for the positions. A hesitating occupation of entrepreneurship chairs can be observed in several cases (Lilischkis, 2001, 98). For 2002, Klandt (2004) recorded 39 entrepreneurship professorships in Germany, and another 8 professorial positions which were not yet filled (Klandt, 2004, 297).

Education and training is undoubtedly the main objective for an entrepreneurship teacher. Also, in order to sensitize and motivate students to participate in entrepreneurship courses and to consider an entrepreneurial career, it is important to stimulate an entrepreneurial culture at Universities. For those students who are already nascent entrepreneurs another important objective must be taken into account. Consulting, coaching and intermediation into regional networks are other important objectives for entrepreneurship teachers. Contacts to professional actors and institutions as banks, venture capitalists, lawyers, or science parks are essential for the setup and the establishment of the new venture.

Not only entrepreneurship chairs, but also within the field of traditional business administration, teachers provide several courses with a focus on entrepreneurship, mostly in combination with the origin field (e.g. innovation and technology management, small and medium-sized enterprise management). A higher perception of entrepreneurship activities at Universities and

the impulse for others was also initiated by the Federal Ministry of Education and Research. The program EXIST was set off in 1998 in order to merge resources of different actors on a regional platform and to foster the establishment of regional networks.

2.3 Best Practice and Focused Target Groups

Although entrepreneurship is evolving fast as a field of research and teaching, specific research on entrepreneurship education is still sparse. Garavan and O'Cinneide (1994) summarize literature on entrepreneurship education, and, in regard to the theory discussion, say that there is a "(...) lack of accepted paradigms or theories of entrepreneurship education and training (Garavan and O'Cinneide, 1994, 4). Precisely because it is still a very young field of research, there are no prevailing opinions about how to teach entrepreneurship as yet. Main objectives in teaching and didactical content differ from author to author. Due to a broad spectrum of definitions, entrepreneurship education includes more than a mere imparting of business knowledge such as financing, controlling or marketing.

According to Braukmann (2001), one prevailing opinion in the field could be described as a tripartite structure consisting of operational knowledge, method competences and skill-building or social competence (Braukmann, 2001, 83). He subsumes that these three domains are necessary factors for a comprehensive professional capability. Even if business knowledge is a very elementary capacity of a founder, disregard of method and social competence is still common. Garavan and O'Cinneide (1994) state that "the objectives of a successful programme will have an appropriate mixture of knowledge, skill competence and attitude domains of learning" (Garavan and O'Cinneide, 1994, 13 and 19).

Target groups of entrepreneurship programs and training are not only reduced to those who intend to start up a business or who are already nascent entrepreneurs. (Fallgatter, 2004, 40). Garavan and O'Cinneide (1994) observe a high diversity of the target population and demand a higher specification and better definition of the needs of the participants in order to achieve relatively homogenous groups.

Therefore, differences in target groups and a reasonable segmentation for course design should be taken into account. If heterogeneous target groups with different proficiency levels are treated as if they had the same demands and preferences, the result is an inefficient implementation of courses. Figure 12.1 illustrates different criteria for segmentation.

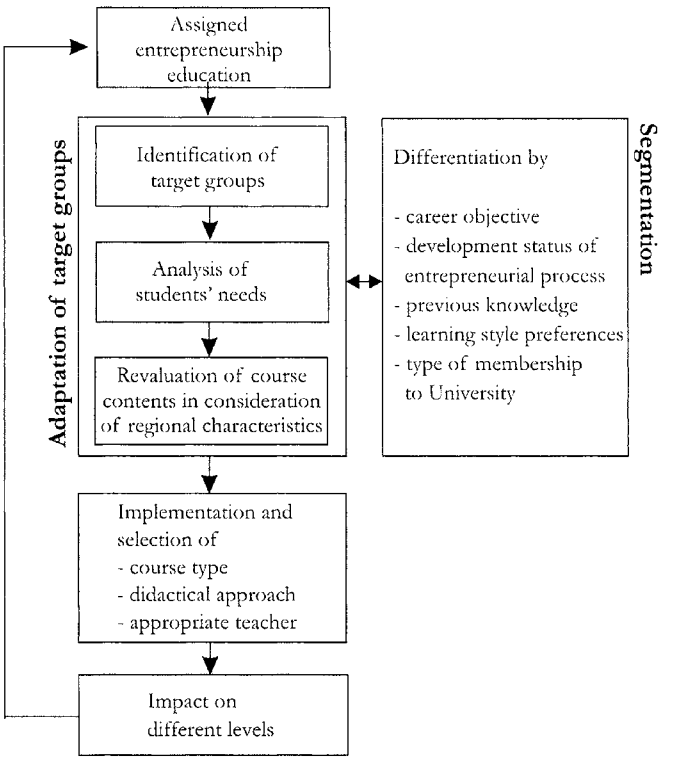


Figure 12.1: Segmentation and adaptation of different target groups.

At first, motivation and choice decision to participate in a course can also occur due to academic restrictions, as the course is mandatory and a core course in the curriculum. Students could indeed be interested in the topic of entrepreneurship but plan to work as a company employee later. Thus, one distinction depends on the individual career objectives. If there is indeed a willingness or propensity to become an entrepreneur one day, the development status in the entrepreneurial process could be an important influence on the right course content. In addition, the previous knowledge of a person whose field of study is business administration will be different from that of someone studying natural sciences, and may also result in different learning style preferences. Some might prefer to attend a course involving guest speakers, whereas others may prefer a traditional lecture course. Applying mixture regression models in a conjoint analysis, Bau *et al.* (2005) identified significant differences in learning style preferences among a group of business students taking an entrepreneurship course. Thus, even in demographically homogenous groups, segments of students with different preferences and needs do exist.

If target groups are identified and different segments are clear, it is crucial to analyze specific needs for every target group. One consideration could be

that the group of business students will probably need more method training and techniques in order to identify opportunities, while the group of technically oriented students will mainly need basic knowledge of business in order to manage professional requirements for a business, even if the idea is already developed.

As regional characteristics and the establishment of a supporting network structure of instructors and consultants may influence students' educational needs, specific conditions and structures must also be taken into account. Here, the term region does not describe an administrative district. Even if the term obviously refers to the specific size of a territory, it seems more appropriate to emphasize the impact of universities, as they are the main focus and starting point for entrepreneurship education and support. For our purposes, the term 'region' describes a specific context of activity and networking based on institutional and spatial proximity (Blotevogel, 2000, 503). The spatial extent of regional activities is limited both for network partners and target groups, spatial proximity is of a high value between network actors, and entrepreneurial support is mainly located close to the university.

In regard to regional characteristics, a differentiation can be made between the size of the regional network and the number of partners involved in order to support the planning process for new ventures. The network focuses on actors involved in universities, such as academics, instructors, and those responsible for technology transfer, but also includes actors outside universities, such as are lawyers, business plan competition organizers, regional support offices, banks or regional private equity funds, science parks or associations within the regional environment. An important determinant for an efficient network is the degree of regional collaboration between university actors and other actors from the regional environment. Financial support from the government may also influence and enhance the performance and establishment of regional entrepreneurship education and support.

Hence, the research areas and research design of this empirical study will be described in the following.

3. The Empirical Study

3.1 Selection and Characteristics of Research Areas

The selected research areas represent different types of a regional network structure with regard to entrepreneurship education activities. The selection of the regions was carried out according to different characteristics. Selection determinants primarily depended on the size and number of partners of the supporting network. Determinants were also dependent on the embeddedness of university actors in the regional environment, and on the existence and number of entrepreneurship courses offered at the universities. As financial

support from the government plays an important role in establishing entrepreneurship education structure in a region, it also forms a selection criterion.

For state-aided regions (such as the state-run EXIST-program), network organization receives external financial support in order to install positions and activities. Meetings between the actors of those networks are inevitably predetermined due to their obligation to report. Spatial proximity and small network size have become less important than for self-organized regions. Actors in regions without any governmental support need to structure themselves and undertake a high degree of self-organization that depends on the ability and willingness of every member to take part. Governmental financial support can therefore be an important impulsion to manage and activate resources and network actors.

The selected research areas have undergone distinctive paths of development in terms of entrepreneurship education and support and are represented as follows:

- state-aided (EXIST) region GET UP in Thuringia, consists of the universities of Jena (University and University of Applied Science), Ilmenau (Technical University), Schmalkalden (University of Applied Sciences) and Weimar (University). The entrepreneurial network has around 60 associated network members, is highly organized and institutionalized by governmental support, and was recently extended to include the whole federal state of Thuringia by three more universities.
- Regensburg, located in East Bavaria, includes the University and the University of Applied Sciences, and can be characterized by several network actors, but which has no coordination or institutionalization.
- Würzburg, located in North Bavaria, consists of the University and the University of Applied Sciences and exists of only loose actors at the universities with sporadic offerings of entrepreneurship education.

Every region represents a specific network structure and owns quite different numbers of network actors, meaning that different types of entrepreneurship courses are offered at the universities.

3.2 Research Design and Description of the Sample

The data presented was collected in two different studies both focusing on the perceptions of the target groups of entrepreneurship education and activities. Part of the research design is identical in both surveys. The first survey was conducted with participants of entrepreneurship courses at the universities in the research areas and represents a selection bias of those who decided to take attend a course. The aim of this study is to identify students' entrepreneurial intentions, different target groups and motivations to visit entrepreneurship courses.

For the *GET UP* region, the two universities Jena and Weimar were selected. Bauhaus University Weimar represents a university with an emphasis on arts and technology, with only four degree programs: architecture, design, media and engineering.

The selected entrepreneurship courses were the only ones offered in the winter semester 2003/2004 at each university. The courses in Jena, Regensburg and Würzburg were located in the Business Administration faculty, while the course in Weimar was offered by the media faculty. All courses were held by university teachers who are not from entrepreneurship chairs, but are teachers integrating a dedicated entrepreneurship course into their field (e.g. Innovation and Technology Management, Marketing, International Management). Using a written questionnaire, all students attending these entrepreneurship courses at their university took part in the survey (full survey). Three out of four courses were held regularly from the beginning of the winter semester until the end of the semester; the only course in Jena was held as a block course of six days in November 2003. The survey was conducted at the beginning of the course in order to presume similar conditions for courses.

The smallest group of participants in the sample was the seminar held at the University of Würzburg, where 15 datasets were collected (table 12.1). 34 datasets were the result of the course in Weimar, where students mainly came from media (24 out of 34) and architecture (8). A total of 43 questionnaires were counted in Jena and the largest course with 87 participating students was to be found at Regensburg. This set of courses covered a total of 179 students. All courses were offered to students in their advanced study period between their third and fifth year of studies.

Table 12.1: Course design

	Number of participants	Course form
Würzburg	15	Seminar
Weimar	34	Seminar
Regensburg	87	Lecture with seminar
Jena	43	Seminar
total	179	

Source: Authors' questionnaire.

The second study was conducted as a campus survey, where oral interviews were done with students from all over the same universities where the participant survey was held and provides a representative random sample of each university selected.

The sample of this study (named campus-sample below) is also utilized as a control group for the participant-sample. Results are expected to be different by group – while the participant group is already sensitized and dealing with

the subject, the other group is notably unaware of and less educated about the topic. Interviewers were advised to disperse to specific locations all over the campus (e.g. libraries, refectory, cafeteria) to make sure of interviewing students from almost all degree programs. Results by faculty could then be compared and differences detected.

The total sample size of 4,835 students was framed from the four universities and reflected between 5 percent and 10 percent of the total student population at every university (table 12.2).

Table 12.2: Number of students at surveyed universities 2003/2004 and size of sample*

	Number of students enrolled	Sample size	Sample in % of total number
Regensburg	17,216	1,775 (1,204)	10.3
Würzburg	18,219	1,705 (1,269)	9.4
Weimar	4,637	407 (389)	8.8
Jena	19,231	948 (807)	5.0

* Numbers in parentheses indicate sample size without teacher candidates
Source: Authors' questionnaire.

In Regensburg and Würzburg especially, the rate of people studying to become teachers is quite high (32 percent in Regensburg, 26 percent in Würzburg of original sample); even if they are studying a certain subject (e.g. biology, maths), the assumption is that their entrepreneurial intentions tend to be quite low. Therefore, they are listed separately from Master's students (diploma, graduate).

4. Campus Results

4.1 Students' Entrepreneurial Attitudes

The consideration is that students who participate in entrepreneurship courses are more sensitized to activities at their university and to considering an entrepreneurial career. Individual preoccupation with the subject has contributed to the growing intention to start a new venture. The conclusion must be that the rate of potential future entrepreneurs is higher within the participant-sample than in the campus-sample.

Due to the already mentioned differences in career objectives, at different stages of the entrepreneurial process, there may be a wide range of target groups. A differentiation can be made between those who have just considered entrepreneurship as a professional alternative, those who already intend to start a new venture, and, those who are already entrepreneurs or are about to embark on this activity.

Up to a certain point of time, every target group contains a certain number of people. It is certainly possible that someone from the group of those who have considered an entrepreneurial career may appear later in the group of people who already intend to set up a new venture. In contrast, however, not everyone passes through every target group over time.

Empirical evidence has shown that especially concerning those people who state a 'secure' or at least a 'supposable' intention to start a business, only one fifth actually act on their intention within three years. In fact, there is only a weak correlation between intentions and their realization (Bergmann, 2000, 33; Katz, 1989, 48; Krueger and Brazeal, 1994, 95). In the long run, the aim of all governmental, regional or personal support initiatives is to shift the population into belonging to the last target group (nascent entrepreneurs).

The results of students' entrepreneurial orientation show clear differences between regions as well as between participants and campus-students (table 12.3).

In regard to regional differences, Weimar stands out with its high rates for every group and is significantly different from other universities. Bauhaus University Weimar emphasizes arts and technology, and produces quite a low rate of people studying to be teachers (4 percent of sample). Therefore, it stands to reason that students of highly knowledge- and technology-intensive subjects with an added creative bias may result in a higher disposition towards entrepreneurship than at traditional universities. The occupational leaning of Weimar's degree programs (e.g. architecture, design, etc.) is also more related to professional self-employment than others.

In contrast to Weimar, it is also remarkable that the rates of students' entrepreneurial orientation at 'traditional' universities are quite similar and do not differ greatly between regions. In terms of participants in Würzburg, a direct comparison with other regions can hardly be undertaken because the number of participants is quite low (rates in parentheses in table 12.3). Nevertheless, for this small sample, interest in entrepreneurship and the propensity to set up a business are obviously very low (compared to other universities and to the campus-sample).

Differences between participants and campus-students concerning the consideration of entrepreneurship as a professional alternative can be reduced to the fact that participants have already dealt with and considered the subject; in contrast, however, obviously only the consideration of entrepreneurship as an alternative is clearly rated more highly by participants. Concerning ideas already generated or the intention to set up a business, rates of campus-students in Jena and Regensburg are outranked by those of participants.

Table 12.3: Students' entrepreneurial orientation – participants and students (in % of sample)

	Thuringia		Bavaria	
	Jena (n1=43), (n2=948)	Weimar (n1=34), (n2=407)	Regensburg (n1=87), (n2=1770)	Würzburg (n1=15), (n2=1700)
entrepreneur as professional alternative				
- of participants*	60.5 %	88.2 %	64.4 %	40.0 %
- of campus-students*	37.7 %	53.1 %	34.4 %	37.8 %
Intention to start a new venture				
- of participants*	7.0 %	29.4 %	8.0 %	(6.7 %)
- of campus-students*	12.0 %	13.1 %	9.6%	8.7 %
thereof about to start or have already started				
- of participants	2.3 %	17.6%	8.0 %	(6.7 %)
- of campus-students*	1.1 %	3.2 %	1.6 %	0.9 %

* regional differences significant at 1%-level.
n1= number of participants interviewed, n2= number of students on campus interviewed

Source: Authors' questionnaire.

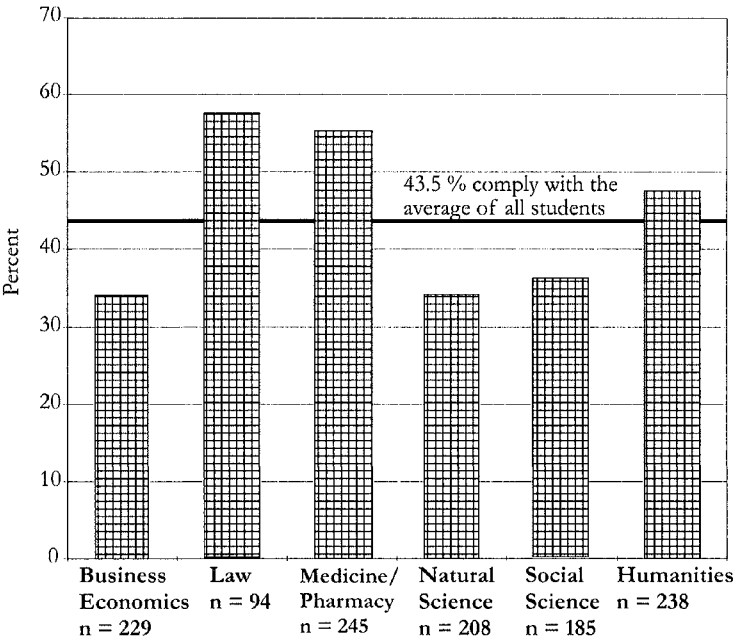
Therefore, entrepreneurship education does not merely exist in order to convince those who are interested to set up their own businesses and to develop the drive to do so. A solely output-approach in terms of created ventures ignores the fact that entrepreneurship also deals with a wide range of entrepreneurial infrastructure, environment, and action within a company. A more realistic personality assessment could also be one objective of entrepreneurship education, even if this means deterring people from becoming entrepreneurs because they realize that they are unsuitable for this kind of professional alternative.

The results from the campus-sample correlate strongly with other empirical findings from several universities (University of Cologne, University of Stuttgart, Technical University of Ilmenau, University of Siegen). Rates of students who are interested in entrepreneurship and regard it as a professional alternative vary between 40 percent and 65 percent of the student population (Bruns and Goerisch, 2002; Otten, 2000; Pinkwart, 2001). Similar surveys of the participant sample have only been conducted sporadically and are hardly comparable to the present case (Price et al., 1994; Sexton and Bowman-Upton, 1988, 1987).

4.2 Differences in Being an Entrepreneur per Faculty

In order to represent one university in Bavaria and one in Thuringia consisting of similar, comparable faculties, the two Universities of Regensburg and Jena are selected to portray student rates considering self-employment as a professional alternative per faculty.

The results show differences as well as similarities (figures 12.2 and 12.3). Similar results for both universities are the high rates of students from the faculties of medicine and pharmacy considering self-employment as a professional alternative and the low rates within the natural science faculty. Not surprisingly for medicine and pharmacy faculty, with a rate above average, students expect to be self-employed later as freelance physicians or pharmacists. Even if many students expect to be self-employed, empirical results show conflicting evidence. Regarding alumni, the rate of people from human medicine who have ever been self-employed is 6 percent of all graduates (Holtkamp and Imsande, 2001, 71).



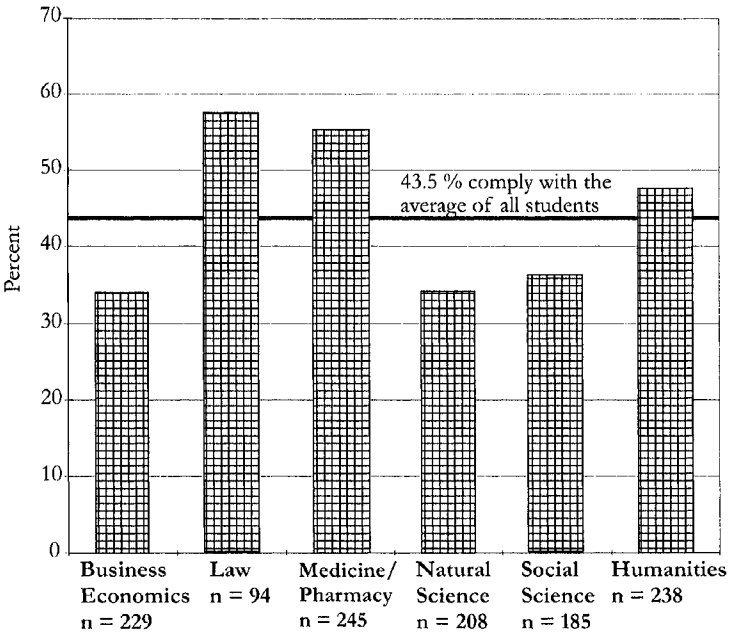
n = 1204, students at the University of Regensburg (without teacher candidates)
* differences between faculties significant at 1%-level

Figure 12.2: Self-employment as professional alternative: rates for Regensburg students.

In contrast, students of natural science from both universities show very below-average rates in regard to considering entrepreneurial careers (34 percent at Regensburg, 24 percent at Jena). Due to the fact that entrepreneurship edu-

cation and activities occur mainly in the Business and Economics faculty, results demonstrate impressively that for a faculty where entrepreneurial activities are traditionally uncommon, activities still do not show effects. Findings of students of natural sciences can be seen as a result of unequally intensive activities of professors depending on the faculty. The rate of those professors who have engaged in entrepreneurial activities (such as consultants, associates, CEOs, on supervisory or advisory boards) is 59 percent in law and economics. In regard to natural science, not even a third of the professors (30.2 percent) have been involved in such activities (Isfan et al., 2005, 345).

The same applies for lawyers in Thuringia, where rates are only slightly above-average, while numbers in Regensburg show clear above-average rates and obvious expectations of becoming self-employed lawyers after graduating.



n = 1204, students at the University of Regensburg
(without teacher candidates)
* differences between faculties significant at 1%-level

Figure 12.3: Self-employment as professional alternative: rates for Jena students.

While the propensity to become an entrepreneur is quite low among students of Economics at the University of Regensburg, the rate of economics students in Jena who prefer entrepreneurship as a professional alternative is above-average. These differences may result in different activities and support structures of entrepreneurship education. While these activities in Jena are highly organized and implemented, the result is a high rate of students of eco-

nomics considering an entrepreneurial career. Also, while faculties in Jena are located both on campus and dispersed over the city, the economics faculty is directly on campus, where there is the most activity concerning promotion and local advertising with flyers, brochures, contact people, etc.

5. Course-Related Results

5.1 Motivation to Visit Courses

Numerous studies have been carried out to evaluate and detect opinions of professional educators. However, Hills (2004) states that it is also important to compare the educators' point of view with the requests and demands of students of entrepreneurship programs (Hills, 2004, 292). Only a few empirical results have been obtained regarding the contents of entrepreneurship courses, and none on the motivation to visit them.

In table 12.4, students' motivation to visit surveyed courses is shown. One possible motivation was to select the course as a mandatory course or as a course as part of the curriculum. The second item was interest in the topic and the third motivation was for help and consulting for the student's own entrepreneurial activities. The results suggest extreme differences between the courses. While 93 percent of Jena's students chose entrepreneurship courses because they were part of their curriculum or even mandatory, only 32.4 percent in Weimar attended the course because it was mandatory. Almost none of Jena's students were looking for support (2.3 percent), compared to 41.2 percent of Weimar's students.

Table 12.4: Participants' motivation for choice (in percent)

multiple answers possible	Jena (n=43)	Weimar (n=34)	Regensburg (n=87)	Würzburg (n=15)
Mandatory course/ core course in curriculum *	93.0	32.4	45.3	80.0
Interest in topic *	41.9	82.4	80.2	26.7
Search for help and consulting for your own start-up *	2.3	41.2	24.4	6.7

* Regional differences significant at 1%-level.

Source: Authors' questionnaire.

Weimar's exceptional position, with its emphasis on arts and technology and a high rate of nascent entrepreneurs (see table 12.3), obviously shows a high need of entrepreneurship support in order to foster creative and knowledge-intensive ideas. A high rate of students in Würzburg whose intentions to attend a course are swayed by the mandatory nature of the course correlates

with the fact that the number of people considering entrepreneurship as a professional alternative is very low.

5.2 Contents of Courses

Course participants were asked for the content they would like to see in entrepreneurship courses. In reference to the tripartite structure of courses (operational knowledge, method competences and skill-building or social competence), contents surveyed include all possible types, as listed in the content table (table 12.5). First, regional differences can be seen according to the location of courses. While courses held in Jena, Regensburg and Würzburg are located in the Business Administration faculty, the one in Weimar is offered by the media faculty. A differentiation according to university can be seen in table 12.5. While the need of course participants in Business Administration to learn about law or operational knowledge such as tax, marketing, etc. is quite low, more than half the participants at Weimar wished to learn more about the two topics operational knowledge and professional skills. The very important impact for Weimar's participants is the fact that, consisting of only four faculties, it does not have an economics faculty. In contrast, the need for Weimar's participants to qualify for social skills is comparatively low, which might also be a result of the fact that Weimar's university is very small. The university environment might be more personal, where it is easier to establish contact with the right people in the network, and communication is less complicated.

Table 12.5: Contents desired by participants (in percent)

multiple answers possible	Jena (n=43)	Weimar (n=34)	Regens-burg (n=87)	Würz-burg (n=15)
Legal basis/ legal advice	28	53	32	7
Operational knowledge (tax, production, marketing, management)	26	53	15	20
Financing, financial models	30	18	32	7
Risk assessment	37	9	30	0
Business plan, knowledge of industry and market	21	24	23	27
Procedure and implementation of planning and creation process	28	15	22	0
Social skills (leadership ability, problem-solving, team-work, presentation skills)	21	15	36	20
Self-management, personal motivation	12	12	8	0
Field reports of entrepreneurs	7	6	12	0
Intermediation of contacts, Integration in networks	7	18	9	13

Source: Authors' questionnaire.

The rather low response rate in Würzburg is also a result of the very low rates of entrepreneurial motivation: most of the students participate because it the courses are a mandatory part of their curriculum. The very few answers (there is no mention of risk assessment, attendance during entrepreneurial activity or personal motivation) are a sign of non-awareness and non-existent individual preoccupation with the topic of entrepreneurship.

6. Conclusions

Our study has shown that entrepreneurship education and activities may attract very different target groups with different intentions and orientations which differ by faculty, by motivation, or by career objective.

Surprisingly, even if regional differences do exist, they cannot be reduced to the originated network structure of every region. Thuringia region is financially supported by the federal government and has a highly developed network structure. Nonetheless the two universities in the region, Jena and Weimar, show very different results concerning students' orientations. Findings from Jena are more similar to the results from Regensburg, with a network of loose actors without any coordination and specified responsibilities, than to those from Weimar, although they are in the same network. In conclusion, students' entrepreneurial orientation and intentions depend hardly at all on regional entrepreneurship organization structure; at best, such tendencies can be seen at small universities like Bauhaus University Weimar, where such activities may make an impact.

Students' orientation and intentions might be considerably affected by the faculty where courses are located and by the size of the university. Different study programs show different levels of entrepreneurial orientation. In Weimar, as an arts- and technology-focused university, our findings document a higher willingness to learn about entrepreneurship (even for a project which already exists) by students of knowledge-intensive and technology-based subjects. In contrast, within the natural science faculty, results show a very low interest in entrepreneurship as a professional alternative. In conclusion, provided that students from disciplines other than economics are aware of the topic and decide to participate in a course in order to deal with the subject, they have a greater intention to become entrepreneurs than economics students.

Not only intentions but also needs and preferences concerning content are affected by different faculties and individual university structures. While participants from a university without a business faculty (Weimar) show a notable demand for operational and legal basic knowledge, others ask for more social skills (Regensburg course participants) or risk assessment (Jena course participants). Additionally, especially for courses with a low rate of (nascent)

entrepreneurs, participants are mainly not in a position to be able to evaluate contents necessary for setting up a new business.

For all cases and all courses, findings show that the only focused target group is undergraduate and Master level students. At any rate, the question as to why no post-graduates participate in courses cannot be answered. Two reasons could be that post-graduates in business economics do not necessarily need the contents, while post-graduates from natural science do not know about courses because barriers between economics and natural sciences exist and activities are therefore not well known. Moreover, as has already been described, most natural science professors do not act as a driving force to support entrepreneurial activity. Even if courses are offered within business faculties they must also be addressed to target groups of other faculties particularly for knowledge-intensive and technology-based subjects where post-graduates could also learn more about the utilization of research findings (e.g. patent application).

Like any other subject, entrepreneurship should be an ordinary part of the educational program of business or economics students, but should also address target groups outside the business faculty. Curricula should not simply focus on the creation of entrepreneurs. Results confirm that (nascent) entrepreneurs are only a small group in courses, and instructors need to know their target groups before they design entrepreneurship programs or courses. Knowing this, a faculty can design programs and individual courses that are better suited to the students' educational needs, and that can even be aimed at students from all faculties.

References

Anderseck, Klaus, 2004, „Duale Ausbildungskonzepte: Ein Weg zum Abbau der Praxisferne in der Entrepreneurship Education." In *Jahrbuch Entrepreneurship 2003/04*, Ann-Kristin Achleitner, Heinz Klandt, Lambert T. Koch, Kai-Ingo Voigt, eds. Berlin, Heidelberg: Springer.

Bau, F., Wagner, K., Steiner, W.J., Baumgartner, B., 2005, Students' Preferences for Entrepreneurship Education. An Application of Conjoint Analysis, *Regensburger Diskussionsbeiträge zur Wirtschaftswissenschaft*, Nr. 401.

Bergmann, H., 2000, Gründungspotenzial und Gründungsengagement im Spiegel des Sozioökonomischen Panels (SOEP), *Schriften und Materialien zu Handwerk und Mittelstand*, Vol. 8. Essen: RWI.

Blotevogel, H.H., 2000, Zur Konjunktur der Regionsdiskurse. *Informationen zur Raumentwicklung*, 9/10, 491-506.

Braukmann, Ulrich, 2001, "Wirtschaftsdidaktische Förderung der Handlungskompetenz von Unternehmensgründerinnen und -gründern." In *Gründungsmanagement*, Lambert T. Koch, Christoph Zacharias, eds. München, Wien: Oldenbourg.

Bronner, R., Mellewigt, T., Späth, J.F., 2001, Gründungsmanagement, *DBW*, 61 (5), 581-599.

Brüderl, J., Schüssler, R., 1990, Organizational Mortality: The Liabilities of Newness and Adolescence, *Administrative Science Quarterly*, 35, 530-47.

Bruns, R.W., Görisch, J., 2002, Unternehmensgründungen aus Hochschulen im regionalen Kontext- Gründungsneigung und Mobilitätsbereitschaft von Studierenden. Working Papers Firms and Region, R1 Fraunhofer Institut Systemtechnik und Innovationsforschung.

Busenitz, L., West, G.P., III, Shepherd, D., Nelson, T., Chandler, G.N., Zacharakis, A., 2003, Entrepreneurship research in emergence: past trends and future directions, *Journal of Management*; 29 (3), 285-308.

Bygrave, W.D., Hofer, C.W., 1991, Theorizing about Entrepreneurship, *Entrepreneurship Theory & Practice*, 16 (2),13-22.

Davidsson, Per., 2003, "The Domain of Entrepreneurship Research: Some Suggestions." In *Advances in Entrepreneurship, Firm Emergence and Growth*, Jerome A. Katz and Dean Shepherd, eds., Vol. 6., Greenwich, CT: JAI Press.

Davidsson, P., Wiklund, J., 2001, Levels of analysis in entrepreneurship research: current research practice and suggestions for the future, *Entrepreneurship Theory & Practice*, 25 (4), 81–99.

Fallgatter, M. J., 2004, Entrepreneurship: Legitimationsprobleme und Konturen einer jungen Disziplin, *Schmalenbachs Zeitschrift für betriebswirtschaftliche Forschung*, 56, 23-44.

Fiet, J. O., 2000, The Theoretical Side of Teaching Entrepreneurship, *Journal of Business Venturing*, 16, 1-24.

Garavan, T. N., O´Cinneide, B., 1994, Entrepreneurship Education and Training Programmes: A Review and Evaluation-Part 2, *Journal of European Industrial Training*, 18 (11), 13-21.

Gartner, W.B., 2001, Is there an elephant in entrepreneurship? Blind assumptions in theory development, *Entrepreneurship Theory & Practice*, 25 (4), 27-39.

Heil, Heinricke A., 2002, "Das Gründungsthema an deutschen Hochschulen: Eine Positionsbestimmung." In *Unternehmensgründungen. Zwischen Inszenierung, Anspruch und Realität,* Rolf G. Heinze, Frank Schulte, eds., Wiesbaden: Westdeutscher Verlag.

Hills, Gerald, E., 2004, "Entrepreneurship Education: Market Segmentation and Learner Needs." In *Entrepreneurship. The Way Ahead*, Harold P. Welsch, ed. New York: Routledge.

Holtkamp, Rolf, Imsande, Jens, 2001, *Selbständigkeit von Hochschulabsolventen. Entwicklung, Situation und Potential.* HIS Kurz-Information A 2. Hannover.

Isfan, Katrin, Moog, Petra, Backes-Gellner, Uschi, 2005, „Die Rolle der Hochschullehrer für Gründungen aus deutschen Hochschulen- erste empirische Erkenntnisse". In *Jahrbuch Entrepreneurship 2004/05. Gründungsforschung und Gründungsmanagement*, Ann-Kristin Achleitner, Heinz Klandt, Lambert T. Koch, Kai-Ingo Voigt, eds. Berlin, Heidelberg: Springer.

Katz, J. A., 2003, The chronology and intellectual trajectory of American entrepreneurship education 1876-1999, *Journal of Business Venturing*, 18 (2), 283-300.

Katz, Jerome A., 1989, "Intentions, Hurdles, and Start-ups: An Analysis of Entrepreneurial Follow-Through." In: *Frontiers of Entrepreneurship Research 1989*, Robert H. Brockhaus, Neil C. Churchill, Jerome A. Katz, Bruce A. Kirchhoff, Karl H. Vesper, William E. Wetzel, eds. Babson College. Waltham, Mass.

Klandt, H., 2004, Entrepreneurship Education and Research in German-Speaking Europe, *Academy of Management Learning and Education*, 3 (3), 293-301.

Krueger, N., 1994, Brazeal, D.V. Entrepreneurial potential and potential entrepreneurs, *Entrepreneurship Theory and Practice*, 18 (3), 91-104.

Lilischkis, Stefan, 2001, *Förderung von Unternehmensgründungen aus Hochschulen.* Eine Fallstudie der University of Washington (Seattle) und der Ruhr-Universität Bochum, Lohmar, Köln: Eul.

Low, M.B., MacMillan, I.C., 1988, Entrepreneurship: Past research and future challenges, *Journal of Management*, 14, 139-61.

Otten, C., 2000, Einflußfaktoren auf nascent entrepreneurs an Kölner Hochschulen. Working Paper 2000/3 University of Cologne, Department of Economic and Social Geography.

Pinkwart, A., 2001, Unternehmensgründung aus der Hochschule, *Materialien zur Mittelstandsökonomie*, Nr. 4, Universität Siegen.

Pinkwart, Andreas, 2000, „Entrepreneurship als Gegenstand wirtschaftswissenschaftlicher Ausbildung." In *Existenzgründung. Rahmenbedingungen und Strategien*, Günter Buttler, Harald Herrmann, Wolfram Scheffler, Kai-Ingo Voigt, eds. Heidelberg: Physica-Verlag.

Price, C., Allen, K., Monroe, S., 1994, "The effects of geographical and socio-economic differences on the replicability of entrepreneurial training programs. In *Frontiers of entrepreneurship research,* William Bygrave, Sue Birley, Neil C. Churchill, Elizabeth Gatewood, Frank Hoy, Robert Keeley, William R. Wetzel jr., eds. Boston, MA: Babson College.

Schmude, J., Uebelacker, S., 2002, *Gründungsausbildung in Deutschland und den USA. Eine Analyse zur Organisation und Ausrichtung von Entrepreneurship-Professuren.* DtA-Studie. Bonn.

Sexton, D.L., Bowman-Upton, N., 1988, Validation of an Innovative Teaching Approach for Entrepreneurship Courses. *American Journal of Small Business*, Winter, 11-22.

Sexton, D.L., Bowman-Upton, N., 1987, Evaluation of an Innovative Approach to Teaching Entrepreneurship. *Journal of Small Business Management*, January, 35-43.

Shane, S., Venkataraman, S., 2000, The Promise of Entrepreneurship as a Field of Research. *Academy of Management Review*, 25 (1), 217-26.

Wöllner, K.-H., 1991, Institutionelle Rahmenbedingungen von Gründungsforschung und -lehre im deutschsprachigen Raum. In *Innovations- und Technologiemanagement*, Detlef Müller-Böling, Dietrich Seibt, Udo Winand, eds. Stuttgart:Poeschel Verlag.

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