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Entrepreneurship and Economic Performance – The Impact of New Firm Formation on Regional Development and Individual Behavior

Von der Fakultät für Wirtschaftswissenschaften
der Technischen Universität Bergakademie Freiberg
genehmigte

Dissertation

zur Erlangung des akademischen Grades
doctorum rerum politicarum
(Dr. rer. pol.)

vorgelegt

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Tag der Verleihung: 20. April 2006

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1 Introduction

1.1 Purpose and Relevance

Economists and policy makers are recognizing entrepreneurship as an engine of economic growth. With the 2003 Green Paper on Entrepreneurship, the European Commission committed itself to entrepreneurship in order to foster the entrepreneurial drive and to achieve a greater number of new, prosperous, and innovative firms (EU, 2003). Market entry of new firms is valued as a vehicle to increase the competitive pressure, thereby forcing existing firms to improve efficiency or introduce innovations, which spurs economic growth (EU, 2003; Audretsch et al., 2006; Audretsch, 2002). It is not new to link entrepreneurship to economic growth. In his seminal work in 1911, Schumpeter recognized entrepreneurial initiatives as a mechanism for creative destruction challenging and displacing less innovative incumbents, which consequently leads to a higher degree of economic growth.

The post–World War II era can be characterized as a period where scholars and policy makers believed that employment, innovation and growth lay in the domain of large corporations. Research was focused on the sources and means of market concentration and how to achieve optimal capacity. Market entrants and small firms were not perceived as agents of innovation and change, but rather as firms increasing suboptimal capacity by market segmentation (e.g. Chandler, 1977; Weiss, 1964). In 1979, Birch published the idea that small and young firms create most of the jobs; no longer were large firms, but small firms, the major providers of new jobs in the United States (Birch, 1981; see also Greene, 1982; Davis et al., 1996a, 1996b). Although his study suffers from methodical shortcomings and his conclusions have been discussed controversially, small and new firms were again recognized as an important source of job creation and economic dynamism.

Empirical evidence shows that entrepreneurial activity tends to cluster geographically; hence, the formation of firms varies greatly between regions. The importance of entrepreneurship and its spatial variation were underlined by three spe-

cial issues of *Regional Studies* over 20 years. In 1984, the special issue *Small Firms and Regional Development* made an important contribution to the entrepreneurship research by empirically justifying the relevance of new firms for economic prosperity. Ten years later, in 1994, the special issue *Regional Variations in New Firm Formation* explored the question why regional variations in new firm formation rates exist. Interestingly, studies on different countries such as the United States, the United Kingdom, Germany, Sweden, Italy, and Ireland found very similar results. First, the regional start-up rates were approximately the same in the different countries. Secondly, the ratio between regions with the highest and those with the lowest start-up rates were found to be similar. Finally, while a high proportion of employment in small firms was found conducive to higher firm formation rates, mechanisms such as government assistance programs aimed at enhancing start-up activity hardly affected new firm formation rates. In 2004, the third special issue *Entrepreneurship and Economic Development* was published. Most papers in this issue explained employment change by new firm formation activity. Beyond these three special issues, the empirical evidence indicates that the economic role of entrepreneurship has dramatically increased since the late 1970s (e.g. Casson, 1982; Storey, 1982, 1994; Acs and Audretsch, 1990; 2003; Baumol, 1990; Geroski, 1995; Parker, 2004).

Despite the growing body of research on entrepreneurship, a generally accepted definition of entrepreneurship does not exist yet. The statement of Bruyat and Julien (2001) that "the problem of defining the word 'entrepreneur' and establishing the boundaries of the field of entrepreneurship still has not been solved" still applies (see also Shane and Venkataraman, 2000; Parker, 2004; Audretsch et al. 2006). There are several competing definitions that are commonly used by researchers and policy makers. The Organization for Economic Co-operation and Development (OECD) proposes that "entrepreneurs are agents of change and growth in a market economy and they can act to accelerate the generation, dissemination and application of innovative ideas. […] Entrepreneurs not only seek out and identify potentially profitable economic opportunities, but are also willing to take risks to see if their hunches are right" (OECD, 1998:11). Definitions of entrepreneurship usually vary with regard to the research perspective and question (see Lundström and Stevenson, 2005: 41-45 for an overview). Entrepreneurship is quite complex, involving both individuals and

firms; thus, requiring analyses on the level of individuals, firms, industries, regions, and countries.

In empirical analyses, however, entrepreneurship needs to be operationalized (for an overview of measurements, see van Stel, 2005). First, entrepreneurship refers to the start-up process, which is operationalized by the number of start-ups. In order to draw interregional comparisons, start-up rates are calculated. Hence, the number of start-ups is set in relation with the regional economic potential such as the regional workforce (for different approaches of calculating start-up rates see Audretsch and Fritsch, 1994a). Secondly, entrepreneurship may apply to the entrepreneurial environment or the entrepreneurial capital of a region (Audretsch and Keilbach, 2004a; Audretsch et al., 2006). This may be measured by the share of small and young firms or the share of employees in small and young firms. Thirdly, analyses on the level of individual behavior usually understand entrepreneurs as business founders, small business owner-managers, or self-employed (Parker, 2004; Davidsson, 2005). A new strand of literature deals with nascent entrepreneurs, namely individuals who attempt to start a venture. The Global Entrepreneurship Monitor (GEM) and the Panel Study of Entrepreneurial Dynamics (PSED) classify individuals as nascent entrepreneurs if they are individually or with others actively involved in starting a business that will at least partly belong to them. However, they should not have paid full time wages or salaries to themselves and others yet (Reynolds et al. 2004a, 2004b). Consequently, the idea behind nascent entrepreneurship is the study of firms in the gestation process – the analysis of start-up efforts that have not yet resulted in up-and-running businesses (see also Davidsson, 2005: 1–4).

Between 1984 and 2002 about 126,000 start-ups with a least one employee were founded each year in West Germany in the private sector (Fritsch and Mueller, 2006).[1] Most of the start-ups were located in the densely populated areas. This distribution corresponds to the distribution of employees and incumbent firms. More

1 Most analyses of this thesis are restricted to West Germany, because the post-socialist East German economy of the 1990s showed a unique pattern regarding the evolution of new firm formation activity and economic performance (Fritsch, 2004). The evidence indicates that the economic capability of East German regions is still not comparable with West German regions. Economic disadvantages are particularly rooted in lower technical progress, a lack of entrepreneurship, lower business and industrial concentration, and a loss of human capital (Kronthaler, 2005).

than 70 percent of the start-ups are set-up in the service sector and only about ten percent in manufacturing industries. Regional start-up rates ranged between four and fourteen, if new firms are set in relation with the regional workforce. This kind of start-up rate is based on the notion that all members of the workforce are faced with the decision to work as paid-employees or to start a venture. Because start-ups are usually located close to the founder's residence (Gudgin, 1978; Sorenson and Audia, 2000), the regional workforce can be regarded as an appropriate measure of the number of potential entrepreneurs. There is high variation between start-up rates over space (figure 1.1). On average seven new firms are started per 1,000 members of the regional workforce. Only eight out of 74 regions show a start-up rate higher than nine. Generally, start-up activity tends to be higher in the northern part of West Germany and in the regions south of Munich and Cologne.

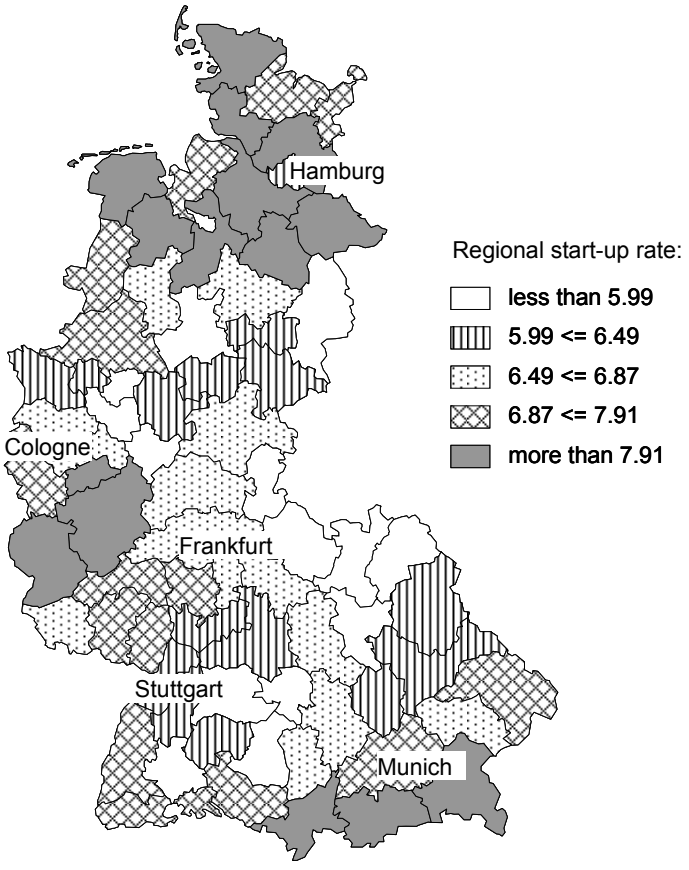

Figure 1.1 Average start-up rates in West Germany between 1984 and 2002

The obvious consequence of new firm formation is that the entrants create new employment as long as they are in the market, e.g. the direct effect of new firm formation on regional development. Additionally, several modes have been identified through which newcomers indirectly foster economic development. First, market entry, either actual or possible, contests market positions of incumbent firms, which secures the efficiency of the active businesses (Baumol et al., 1988). Secondly, start-ups may serve as a conduit of structural change (Schumpeter, 1911; Audretsch, 1995). In this case, newcomers force inefficient incumbent firms to exit the market. Thirdly, newly generated knowledge and inventions may not be exploited by incumbents but rather by new ventures (Acs et al., 2005). Economic growth is expected to be larger if new firms use the underexploited knowledge and introduce innovations to the market. Finally, if new firms introduce innovations, this will lead to a greater variety of products and processes, which will consequently result in higher competitiveness of an economy or a region (see also Henderson et al., 1995).

1.2 Scope and Structure

The main objective of the present thesis is to contribute to the field of entrepreneurship in the areas of new firm formation, regional economic development, and individual behavior (figure 1.2). The first research theme addresses the spatial variation but temporal persistence of new firm formation activity. The thesis thereby complements other studies on regional determinants by additionally investigating factors that explain why some regions experience an increase in regional start-up activity. The second theme of this thesis examines why entrepreneurship matters. In particular, this thesis analyzes the impact of new firm formation on regional development. Regional development is measured in different ways, namely as employment change, labor productivity, and economic growth rates. Finally, the impact of the entrepreneurial environment on the individual decision to start a firm is investigated. This research question leads back to the first research theme by addressing the persistence of new firm formation from the individual perspective.

This dissertation consists of a compendium of papers. Although the papers have a common research agenda, they can be read independently. All papers were presented at conferences or workshops.[2] Each paper employs empirical analysis to explore the phenomenon of entrepreneurship. Three papers additionally explore the impact of entrepreneurship on economic performance. Most data were drawn from the German Social Insurance Statistics (e.g. the number of employees, existing firms, and start-ups) and the ZEW Foundation Panel (innovative new firms). Data on regional characteristics, e.g. regional gross value added, researchers and industrial grants at universities were provided by the Federal Statistical Office. The German Socio Economic Panel (SOEP) conducted by the German Institute for Economic Research supplied data on individual characteristics of potential entrepreneurs. A detailed description of the employed data can be found in each chapter.

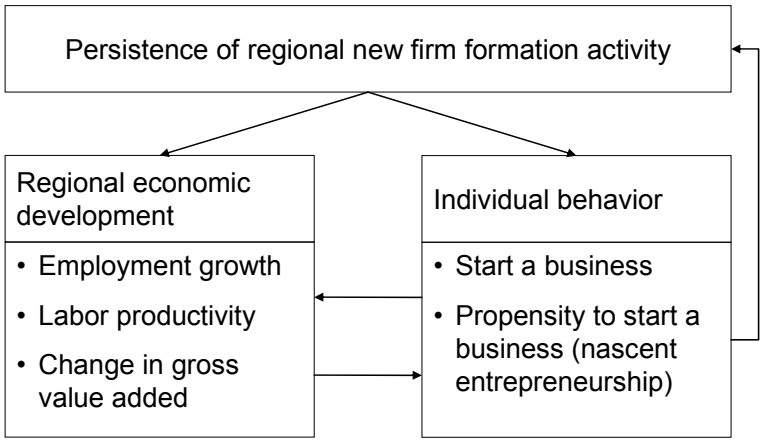

Figure 1.2 Impact of entrepreneurship on economic performance and individual behavior

The contribution of the first paper *"The Persistence of Regional New Business Formation-Activity over Time"* (chapter 2) is that it analyzes the inertia of regional new firm formation activity and the magnitude and pace of changes over a period of 20 years. The paper demonstrates that a high level of persistence in new firm formation leads to a region-specific growth path. It can be assumed that a region with a high level of entrepreneurial activity is more likely to experience faster structural change and stronger economic growth. Consequently, those regions with a low level

2 These conferences and workshops include, for instance, the Annual Conference of the Schumpeter Society, Interdisciplinary European Conference on Entrepreneurship Research, the International Triple Helix Conference, several workshops at the Max Planck Institute of Economics, and the Congress of the European Regional Science Association.

of entrepreneurial activity face severe problems in case of exogenous shocks. In particular, regions with a high concentration of mature industries have difficulties in attracting new industries and generating new firms in order to replace employment losses (Henderson et al., 1995). For policy measurements it is therefore important to examine the factors stimulating an upward shift in new firm formation. If regions succeed in overcoming an initial low level of new firm formation activity, these regions gain potential to spur structural change and close the gap to faster growing regions. Nevertheless, this process requires a long time period.

The paper *"Effects of New Business Formation on Regional Development over Time"* (chapter 3) sheds light on the ambiguous evidence regarding the relationship between new business formation and employment change by considering the immediate and long term consequences of start-ups. This chapter is based on the pioneering study by Fritsch (1996), who analyzed the relationship between entry rates and employment change between 1986 and 1989 for the 75 West German planning regions. His results were ambiguous; while entry rates proved to have a positive effect on employment change in manufacturing industries two or three years after their founding, the employment effects of entries in the service sector as well as in the overall private industries were negative. This evidence suggests that longer time lags are necessary for the main consequences of new businesses to take effect, which may explain the missing link between start-up activity and employment growth. Later on it was found that regional start-up rates for West Germany in the 1980s were unrelated to employment growth in the 1980s, but they were positively related to employment growth in the 1990s (Audretsch and Fritsch, 2002). These long term employment effects of start-ups are evident in British regions as well (van Stel and Storey, 2004). The particular contribution of chapter 3 is that it accounts for the direct and indirect effects of new firm formation activity on regional employment growth. Furthermore, it examines both the time-series and cross-section dimension of the data, which make it possible to control for unobserved heterogeneity between the regions.

The question of, why regions experience different economic performance in regard to entrepreneurial activity, is the underlying theme for the next two chapters: *"Exploring the Knowledge Filter: How Entrepreneurship and University-Industry*

Relationships Drive Economic Growth" (chapter 4) and *"Exploiting Entrepreneurial Opportunities: The Impact of Entrepreneurship on Growth"* (chapter 5). Neoclassical growth theory focuses on the region's endowment of capital and labor, and their impact on economic output (Solow, 1956). However, knowledge, which is omitted in the neoclassical approach, is an important ingredient for economic growth (Romer, 1986). New growth theory proposes that knowledge stimulates technological progress, thereby increasing productivity and economic growth (Romer, 1986, 1990; Lucas, 1988). Economic growth depends not only on the accumulation of knowledge, but also on knowledge spillovers, which allow third-party actors to commercialize it. Nevertheless, investments in new knowledge and ideas may not automatically spill over and result in new products and processes, as assumed by Romer or Lucas. Rather, a certain kind of filter – the knowledge filter – impedes the spillover and commercialization of newly generated or abundant knowledge (Acs et al., 2005). Entrepreneurship may be able to penetrate this knowledge filter and facilitate the spillover of knowledge, which might otherwise not be exploited, therefore driving economic growth (see also Audretsch et al., 2006).

Chapter 4 and 5 investigate the link between entrepreneurship and economic growth. It is empirically tested if new firm formation is a mechanism for knowledge spillovers, thus penetrating the knowledge filter. In addition university-industry relationships are considered as a vehicle for the diffusion of knowledge. Chapter 4 analyzes regional economic performance, measured as labor productivity, between 1992 and 2002 by employing a production function approach. It is expected that regions with a high level of new firm formation activity also experience greater productivity, which may be especially driven by innovative start-ups. University-industry relationships are assumed to serve as a conduit for knowledge spillovers. The more private firms draw from university knowledge, the greater the regional labor productivity. Chapter 5 is devoted to a similar research question; it analyzes the long term relationship between entrepreneurship and regional economic growth between 1990 and 2002. The empirical analysis estimates the development as compared to the initial condition in 1990. It is proposed that regions which increased their knowledge stock and new firm formation activity experienced stronger economic growth. An increase

in innovative start-ups could be a major driver of economic growth if the incumbents neglect to commercialize the regional knowledge stock to the full extent.

The final paper *"Entrepreneurship in the Region: Breeding Ground for Nascent Entrepreneurs?"* is presented in chapter 6 and proposes that an entrepreneurial environment influences the individual decision whether to become or not self-employed. If individuals in regions with strong entrepreneurial traditions have a higher propensity to start a venture, this could explain the strong persistence of start-up activity. A great number of empirical studies have focused on the characteristics of nascent entrepreneurs analyzing why some individuals try to start a business (see Davidsson, 2005 for an overview). Since individuals face uncertainty and ambiguity during the decision of whether to become self-employed, they are most likely affected by social cues (Aldrich, 2003; Minniti, 2005). In this case the presence of other entrepreneurs may encourage the individual to exploit an entrepreneurial opportunity. Primarily parents, friends, colleagues, and small business owners might provide a good example for setting up a business and function as role model (Wagner, 2004, 2005; Dunn and Holtz-Eakin, 2000; Davidsson and Honig, 2003). In other words, the easier it is to gather valuable information about the start-up process, the larger the number of entrepreneurs. As soon as running a business enjoys high reputation, entrepreneurship is perceived as a career choice (see Aldrich and Fiol, 1994; Saxenian, 1998: 37).

2 Persistence of Regional New Business Formation-Activity over Time*

2.1 The Problem

It is barely disputed that new business formation[3] can have an important stimulating effect on economic development (Carree and Thurik, 2003; Scarpetta, 2003). Nevertheless, recent empirical studies (Fritsch and Mueller, 2004; van Stel and Storey, 2004) have shown that such positive effects of new business formation do not occur immediately but in the medium and long run. It is less clear in which regard public policy is able to influence the level of new business formation. In this paper regional differences in new business formation and their persistence over time are investigated. The results should allow assessing the potential for public policy measures that are aiming to steer the level of regional start-up activity in order to stimulate growth. Moreover, the purpose is to identify appropriate starting points of such a policy. This chapter explores the questions what can be done to promote the regional level of new business formation and when the first results might become visible.

This study is divided into two parts. The first part analyzes the persistence of regional new business formation activity over a period of 20 years in order to assess the magnitude and the pace of changes that have occurred (section 2.3 and 2.4). The second part is devoted to identifying the factors that determine the level and the development of new business formation activity (section 2.5). Finally, section 2.6 discusses conclusions for a policy that aims at stimulating new business in order to promote economic growth. The next section begins with some basic information on the data and on measurement issues.

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* This chapter is based on Fritsch and Mueller (2005b). This chapter has greatly benefited from comments and suggestions made by participants at the IECER and ERSA conferences.

3 The term *new business* is used as the overall category for both new firm headquarters and new plants since the dataset does not differentiate between these two categories of new entities.

2.2 Data

The information on start-ups 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 data on West Germany are currently available on a yearly basis for a relatively long time period ranging from 1983 to 2002. Start-ups consisting of only owners are not included because the database records only businesses with at least one employee.

The analysis is restricted to West Germany because many studies indicate that the East German economy in the 1990s was a special case with very unique conditions that cannot be directly compared to those of West Germany (Brixy and Grotz, 2004; Fritsch, 2004). The Berlin region was also excluded due to changes in the definition of that region during the time period under inspection. Furthermore, the spatial framework is on the level of planning regions. The advantage of using planning regions instead of districts is that these regions include at least one core city as well as its surroundings. The spatial concept of planning regions focuses on commuter distances, therefore they account for travel to work areas and provide a better representation of functional spatial economic entities than districts. The current definition of planning regions, which came into force in 1996, was used for the entire period under consideration (for details see the Federal Office for Building and Regional Planning, 2003).

The number of start-ups that occur in a region within a certain time period are only of limited significance for an interregional comparison since it does not account for the economic potentials of these regions. In order to judge if the regional level of start-up activity is relatively high or relatively low compared to other regions, we calculate start-up rates. There are a number of alternative ways to calculate such a start-up rate (Audretsch and Fritsch, 1994a). Start-up rates are estimated according to the labor market approach, which divides the number of start-ups per period by the number of persons in the regional workforce at the beginning of the respective period including unemployed individuals. This kind of start-up rate is based on the notion that all members of the workforce are faced with the decision to work as paid-employees or to start their own venture.

Considering the fact that start-ups are usually located close to the founder's residence (Gudgin, 1978; Mueller and Morgan, 1962; Cooper and Dunkelberg, 1987; Sorenson and Audia, 2000), 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 his or her own business. The data set allows investigating regional development over a long time period. Therefore, path-dependency can be analyzed and the empirical investigation accounts for unobserved region-specific effects by employing the fixed effect estimator.

2.3 The Development of New Business Formation from 1983 to 2002

According to the data, about 2.64 million new businesses in the private sector were founded between 1983 and 2002. On average, there were 126,000 start-ups per year. Over the years, the number of start-ups increased slightly with a relatively distinct rise between 1990 and 1991 and between 1997 and 1999.[4] On average about 132,000 new businesses were set up between 1990 and 1997, an increase of 12 percent. The 1998 to 2002 period is dominated by an extremely high number of new businesses in 1999 and 2000 leading to an average number of 153,500 start-ups per year. Overall, about 74 percent of all start-ups were in the service sector compared to about 11 percent of all start-ups in manufacturing and 15 percent in the remaining private sector (e.g. agriculture and forestry, fishery, energy and water supply, mining, and construction).

There was an overall trend towards an increasing share of start-ups in the service sector and a corresponding decreasing share in manufacturing (figure 2.1). In the service sector, the largest number of new establishments was set up in wholesale and resale trade, hotels, and in the non-specified other services. In manufacturing, most start-ups were in sectors such as electrical engineering, furniture, and food.

4 The reasons for these two increases are largely unclear. It would not be very farfetched 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.

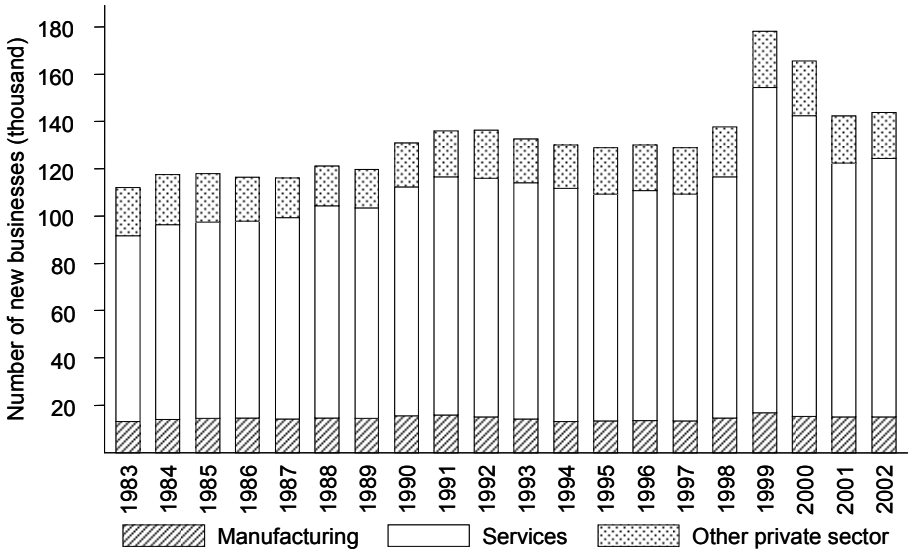

Figure 2.1 Number of start-ups per year in West Germany 1983 to 2002

Most of the start-ups between 1983 and 2002 (about 56 percent) were located in the densely populated agglomerations, while 32 percent were in moderately congested regions, and only 11 percent were in rural areas. This distribution corresponds to the distribution of employees and incumbent businesses; about 54 percent of the incumbent businesses and 57 percent of the employees are located in the agglomerations.

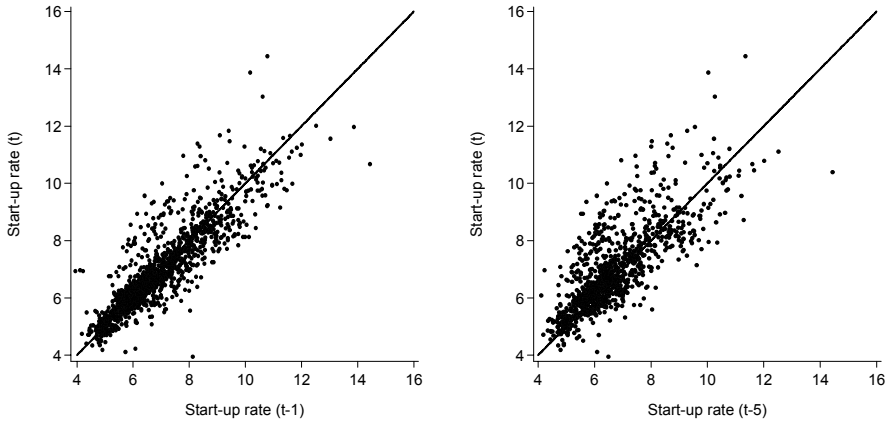

Figure 2.2 Relationship between start-up rates in subsequent years (t and t–1) and over a ten year period (t and t–10)

There is a large variation between start-up rates over space (figure 2.2). While some regions had less than four new businesses per 1,000 persons in the workforce, 50 percent of the regions had less than seven new businesses per workforce and only five percent had a start-up rate of more than 10. The maximum start-up rate

amounted to a little more than 14 new businesses per 1,000 persons in the workforce. The development of new business formation activity was rather steady not only in West Germany as a whole but also on the regional level (figure 2.2). Start-up rates (number of new businesses per 1,000 persons in the workforce) are used to be able to draw comparisons between the different planning regions. The analysis demonstrates a rather high correlation between regional start-up rates in different years as well as a great degree of variation between the regions (figure 2.2). In most cases, the correlation coefficient of start-up rates in subsequent years assumes values between 0.96 and 0.98. The relationship is not as close for years that are farther apart, but even over a 10, 15, and 19 year period the value of the correlation coefficient always remains above 0.8 (table 2.2). There is some slight variation with regard to the closeness of the relationship between the different years, but the basic pattern is remarkably constant.

Table 2.1 Persistence of new business formation activity (1984–2002)

	Start-up rate (t)						
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
Start-up rate (t–1)	0.900** (73.13)	–	–	–	–	–	–
Start-up rate (t–2)	–	0.881** (64.03)	–	–	–	–	–
Start-up rate (t–3)	–	–	0.885** (63.14)	–	–	–	–
Start-up rate (t–4)	–	–	–	0.861** (54.37)	–	–	–
Start-up rate (t–5)	–	–	–	–	0.842** (48.44)	–	–
Start-up rate (t–10)	–	–	–	–	–	0.778** (30.12)	–
Start-up rate (t–15)	–	–	–	–	–	–	0.756** (17.13)
R^2-adjusted	0.8097	0.7760	0.7823	0.7406	0.7094	0.6053	0.5694
F-Value	5,348.63	4,099.29	3,986.33	2,955.96	2,346.41	907.51	293.28
Observations	1,258	1,184	1,110	1,036	962	592	222

Notes: ** significant at 1%-level, * significant at 5%-level, t-values in parentheses, beta coefficients.
Year 1999 excluded because of extreme values

Table 2.2 Correlation matrix of start-up rates 1984–2002

	Start-up rate in year																	
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1985	0.97	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1986	0.93	0.96	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1987	0.95	0.96	0.95	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1988	0.89	0.92	0.92	0.95	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–
1989	0.94	0.95	0.94	0.97	0.96	1.00	–	–	–	–	–	–	–	–	–	–	–	–
1990	0.92	0.93	0.92	0.93	0.91	0.95	1.00	–	–	–	–	–	–	–	–	–	–	–
1991	0.92	0.91	0.88	0.94	0.93	0.95	0.91	1.00	–	–	–	–	–	–	–	–	–	–
1992	0.94	0.95	0.92	0.96	0.95	0.97	0.96	0.96	1.00	–	–	–	–	–	–	–	–	–
1993	0.91	0.89	0.86	0.92	0.89	0.94	0.93	0.94	0.96	1.00	–	–	–	–	–	–	–	–
1994	0.91	0.90	0.86	0.91	0.88	0.93	0.91	0.93	0.95	0.97	1.00	–	–	–	–	–	–	–
1995	0.93	0.91	0.88	0.92	0.88	0.93	0.92	0.94	0.96	0.97	0.98	1.00	–	–	–	–	–	–
1996	0.90	0.88	0.86	0.91	0.89	0.93	0.90	0.93	0.95	0.96	0.96	0.97	1.00	–	–	–	–	–
1997	0.88	0.87	0.84	0.90	0.88	0.92	0.90	0.92	0.95	0.96	0.95	0.95	0.96	1.00	–	–	–	–
1998	0.91	0.89	0.88	0.92	0.90	0.93	0.89	0.93	0.95	0.94	0.95	0.95	0.96	0.95	1.00	–	–	–
1999	0.87	0.84	0.81	0.87	0.85	0.90	0.86	0.89	0.92	0.94	0.93	0.93	0.95	0.93	0.94	1.00	–	–
2000	0.86	0.84	0.81	0.88	0.86	0.90	0.88	0.89	0.92	0.93	0.92	0.92	0.96	0.95	0.94	0.97	1.00	–
2001	0.80	0.79	0.76	0.84	0.82	0.86	0.82	0.86	0.88	0.89	0.88	0.88	0.91	0.92	0.89	0.90	0.92.	1.00
2002	0.84	0.82	0.81	0.87	0.88	0.90	0.86	0.90	0.92	0.92	0.91	0.92	0.95	0.95	0.94	0.93	0.96	0.92

Notes: All coefficients are statistically significant at the 1%-level.

Running pooled regressions with the start-up rate as a dependent variable and the start-up rates of previous years as independent variables, the impact of the past start-up rates decline with increasing time distance (table 2.1). However, the high values of the adjusted R^2 suggest that a large part of the variation of regional start-up rates can be explained by previous start-up activity. Obviously, new business formation activity is rather persistent over time – on the national and on a regional level. There is evidence that more than 50 percent of the variance of start-up rates can be attributed to the start-up rate that prevailed 15 years ago (model VII in table 2.1). This indicates that regional new business formation activity is highly path-dependent, and that the effect of this path-dependency probably lasts over a longer time period than the observed period.

Table 2.3 Variation of new business formation activity (1984–2002)

		Mean	Standard deviation	Coefficient of variation over all regions
Start-up rate	overall	6.97	1.49	0.21
	between regions		1.31	0.20
	within regions		0.74	0.11[a]
Number of start-ups	overall	1,798.79	1,464.78	0.81
	between regions		1,443.45	0.80
	within regions		297.86	0.13[a]
Workforce (number of employees and number of unemployed)	overall	267,839.60	222,433.80	0.83
	between regions		222,778.80	0.83
	within regions		21,960.62	0.07[a]

Notes: [a] Mean of regional values.

The variation of start-ups, workforce, and the regional start-up rates is much more distinctive between the regions than within the regions (table 2.3). The average variation coefficient of the number of start-ups within the regions is almost twice as high as the variation coefficient of the number of individuals in the workforce. This indicates that changes in regional start-up rates are more likely caused by changes in the number of new businesses and are less likely caused by changes of the regional workforce.

2.4 Determinants of New Business Formation

An empirical analysis of the factors that determine new business formation can provide indications for policy measures that might be suited to influence regional start-up activity. In order to analyze and discuss possible policy measures two different types of analysis were conducted. First, the focus is on the determinants of the level of regional new business formation (section 2.4.1). This analysis serves as a basis for identifying those factors that determine changes in regional start-up rates (section 2.4.2). Considering that the investigation is limited to the regions of a single country, it naturally neglects those determinants that do not vary much among regions such as the national tax policy or the welfare system.

2.4.1 Determinants of Regional New Business Formation

It is a key hypothesis in the literature that new business formation is closely linked to innovation activity and structural change. Particularly, the qualification of the regional workforce and small firm employment may have a pronounced effect on the level of new business start-ups (see Fritsch and Falck, 2002; Armington and Acs, 2002; Reynolds et al., 1994 for an overview). The following variables have been included into the empirical model in order to analyze their impact on the level of regional start-up activity:

- *Entrepreneurial climate*. Not only small but especially small and young firms can be regarded as seedbeds for future entrepreneurs (Wagner, 2004). Recent empirical studies have shown that employees in establishments which are small or small and young have a considerably higher propensity to start their business than employees in older and in larger establishments (Beesley and Hamilton, 1984; Wagner, 2004; Mueller, 2005). According to Wagner (2004), the combination of both – being a small and young firm – specifically promotes a pro-entrepreneurial attitude. A reason may be that employees in small firms have relatively good possibility of direct contact with the business' founder who may serve as a role model of an entrepreneur. This effect can be particularly pronounced for younger firms in which employees witness the problems and practical solutions involved in establishing a new venture. Furthermore, a high proportion of employment in small firms may also indicate a low minimum effi-

cient size which can be assumed favorable for entry (Fritsch and Falck, 2002). The share of employees working in small and young businesses is used as a proxy for the entrepreneurial climate in the respective region. Businesses were classified as small and young when they had less than 20 employees at the time of their founding and were no more than three years old (source: Social Insurance Statistics).

- *Innovation activity*. Knowledge and ideas are important sources for new business formation. Especially innovative start-ups are more likely to occur in regions that are characterized by a high level of knowledge and innovative activity. Prior knowledge and experience can be regarded as key determinants of the propensity of an individual to set up a business in innovative sectors (Sorensen and Audia, 2000; Klepper and Sleeper, 2005; Agarwal et al., 2004; Shane, 2000; Wagner, 2004; Shepherd and DeTienne, 2005). The regional share of R&D personnel is used as a proxy for innovative activity and measures the regional knowledge stock. Employees are classified as working in R&D if they have a university degree in engineering or natural sciences (source: Social Insurance Statistics).

- *Agglomeration*. Regions with a high density of population and economic activity may have higher start-up rates than rural areas due to better access to large and differentiated markets for input factors s such as capital, labor, and services. Moreover, firms located in agglomerations can be assumed to be more exposed to knowledge spillover of academic institutions and research conducted by other firms in the region. However, the costs of starting a business such as wages and rent for office space are usually higher in a high-density agglomeration than in rural areas. Although, agglomerations provide a large local output market, there can also be a larger number of local suppliers which cause a more intense competition in these markets. Population density is used as a variable to capture these effects (source: Federal Statistical Office).

- *Demand*. New business formation can be driven or restricted by demand. Regional gross value added per workforce is used here as an indicator for the level

of demand and welfare. The percentage change of the regional gross value added measures the development of demand (source: Federal Statistical Office).

- *Unemployment*. Regional unemployment may affect the level of start-up activity in different ways. On the one hand, unemployed persons face rather low opportunity costs when setting up an own business with no other prospects for employment; hence, a high level of unemployment may force individuals to start a business. On the other hand, high unemployment may indicate relatively low demand and correspondingly bad prospects for a successful start-up. Moreover, unemployed persons may have only little capital of their own and, therefore, also limited access to external finance sources. In most of the empirical studies, the impact of the unemployment rate on new business formation was found to be weakly significant or insignificant (Armington and Acs, 2002; Reynolds et al., 1994; Geroski, 1995). A few analyses have found that the change in the number of unemployed had a negative impact on new business formation activity (Reynolds et al., 1994; Sutaria, 2001; Sutaria and Hicks, 2004). Evidence on the micro-level suggests that unemployed individuals have a higher propensity to be a nascent entrepreneur than people in employment (Wagner and Sternberg, 2004). Data on the regional unemployment rate were provided by the Federal Employment Services.

In addition to these variables, the past start-up rate is included in order to analyze the path-dependency of new business formation activity. Indicators for the formal qualification level of the regional workforce showed a high correlation with the share of R&D employment. Consequently, this variable was not included in the models in order to avoid multicollinearity problems. Measurements for the regional welfare level such as gross value added per capita have also not been included together with the regional unemployment rate due to their close statistical relationship.

This chapter analyzes the level of new business formation in the overall private sector. Both, the dependent and independent variables are defined per year. All models have been estimated as pooled regression as well as by fixed-effects panel regression. An advantage of fixed-effects regression over pooled regression is that it accounts for the unobserved region specific effects. A severe disadvantage of the

fixed-effects estimator may be that some variables such as population density tend to be rather time-invariant. Therefore, their effect is included into the region specific fixed effect and not attributed to the respective variable. In order to avoid causality problems, the exogenous variables are lagged one year.[5] The past start-up rate is lagged five years. The change of gross value added relates to the previous five year period. All models control for spatial autocorrelation by including the mean value of the residual in the adjacent regions. The highly significant coefficients for this variable indicate the presence of positive neighborhood effects of new business formation in adjacent regions. However, the estimates hardly differed if this control variable was not included in the models.

The estimations of the determinants of new business formation activity in the overall private sector largely confirm the expectations (table 2.4). The main determinants of regional new business formation are the entrepreneurial climate in a region and innovation activity. The pooled regressions as well as the fixed-effects models prove that innovation activity is conducive for new business formation. This indicates a crucial role of R&D activities for the regional knowledge stock and the creation of entrepreneurial opportunities. According to the estimates the share of employees in small and young businesses has a highly significant stimulative effect on regional start-up activity. Due to the fact that employment in small and young businesses is considerably affected by the level of start-ups in previous periods, the indicator also reflects the persistence of past regional new business formation activity. This may explain why the coefficient for the lagged start-up rate is much smaller in the pooled regressions, which include the share of employment in small and young businesses. The high correlation between the current and the lagged start-up rate is obviously the reason why the past start-up rate is not statistically significant in the fixed effects regressions. Presumably, the effect of path-dependency is included into the fixed-effects here. For the same reason, the coefficients of the employment share in small and young businesses are considerably smaller in the fixed-effect regression as compared to the estimates of the pooled regression.

5 The differences as compared to models in which start-up rates and exogenous variables are for the same year are, however, negligible. This indicates that reversed causality does not appear to be a problem here.

Table 2.4 Determinants of new business formation

	Regional start-up rate							
	Pooled regression				Panel fixed-effects regression			
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Share of R&D personnel (t-1)	–	0.073** (3.62)	0.062* (2.48)	0.032 (1.47)	–	0.969** (9.36)	0.956** (9.29)	0.957** (9.33)
Share of employees in small and young businesses (t-1)	–	0.369** (20.90)	0.370** (20.41)	0.470** (20.96)	–	0.235** (7.54)	0.215** (6.93)	0.196** (6.44)
Log population density (t-1)	–	–0.087** (3.15)	–0.132** (4.65)	–0.051 (1.78)	–	0.543 (0.66)	–0.564 (0.68)	0.126 (0.17)
Change gross value added over 5 year period (t-5)	–	0.006* (2.37)	–	–	–	-0.006** (2.70)		–
Gross value added per workforce (t-1)	–	–	0.497* (2.09)	–	–	–	0.809* (2.19)	–
Unemployment rate (t-1)	–	–	–	–0.082** (8.08)	–	–	–	0.213** (10.27)
Start-up rate (t-5)	0.803** (67.61)	0.549** (30.51)	0.550** (30.02)	0.464** (22.00)	–0.037 (1.28)	–0.041 (1.26)	–0.043 (1.34)	–0.017 (0.52)
Spatial lag (error)	0.936** (48.46)	0.965** (49.06)	0.965** (47.82)	0.958** (48.76)	0.966** (57.98)	0.962** (51.44)	0.959** (51.98)	0.957** (50.55)
Constant	1.665** (20.47)	1.028** (5.69)	–4.294 (1.64)	1.486** (8.99)	7.289** (37.27)	0.686 (0.16)	–2.365 (0.52)	1.780 (0.34)
R^2-adjusted	0.8860	0.9057	0.9032	0.9070	0.7900	0.7914	0.7936	0.7934
F-value	3447.77	1420.34	1379.87	1442.93	1705.61	573.88	581.73	580.73
Observations	888	888	888	888	888	888	888	888

Notes: ** significant at 1%-level, * significant at 5%-level, t-values in parentheses.

The impact of population density is negative in the pooled regressions indicating relatively unfavorable conditions for start-ups in agglomerated areas. The fact that the coefficient for population density is non-significant in the fixed-effects estimates is probably due to the minimal amount of changes of the value of this variable over the observation period. Therefore, the impact of population density is probably included into the fixed-effects.

Due to multicollinearity problems, the variables gross value added per workforce, change of gross value added, and the regional unemployment rate are not included in the same model. The positive coefficient for the level of gross value added per workforce suggests that a high level of local wealth or demand is conducive for

regional start-up activity. However, the results of the pooled regression and fixed-effects regression for the change of gross value added as well as for the regional unemployment rate are contradicting. According to the pooled regression estimates, a relatively pronounced increase of gross value added as well as low unemployment rates go along with higher regional start-up rates. This result is consistent with other cross-sectional studies of start-up activity (e.g. Audretsch and Fritsch, 1994b; Reynolds et al., 1994). Employing the fixed-effect method, however, the results show a reversed sign for both variables. The results of the fixed-effect regressions suggest that regions with a high growth rate of gross value added had a low start-up rate. Furthermore, in those periods where regions experienced relatively high unemployment rates they had a higher rate of new business formation activity. Specifically, a detailed analysis showed those regions with relatively high start-up rates in the year 2002 also experienced a relatively pronounced increase of unemployment over the ten preceding years.

The analysis of regional start-up rates reveals a high degree of path-dependency as well as a considerable influence of innovation activity. The highly significant coefficients of the past entry rates and the employment shares in small and young businesses clearly indicate the role of a long-lasting entrepreneurial spirit in a region. Compared to these influences the effect of unemployment, local demand change, and population density appears to be of only minor importance.

2.4.2 Why Do Changes of Regional Start-up Activity Occur?

In order to analyze the factors that determine changes of regional new business formation activity, the percentage change of the number of start-ups is used as the dependent variable. The analysis focuses on the long-term development instead of short-term fluctuations. Therefore, the change rate over a period of five years is employed. The explanatory variables were the changes (percentage) of R&D employees and employees in small and young businesses over the previous five year period. In addition, the share of R&D employment as well as the share of employment in small and young businesses is included into the regression. Population density controls for agglomeration economies and other regional characteristics. Gross value added per labor force reflects the regional wealth level and the lagged start-up rate gives the

level of new business formation activity. Model II and IV also contain the change rate of gross value added in the previous five-year period in order to test for the effect of demand on the level of start-ups. Due to the already mentioned correlation between change of regional demand and the unemployment rate, both variables should not be included into the same model. If the models include the unemployment rate instead of the change of gross value added, the coefficient for the unemployment rate is positive. This indicates that high unemployment may force individuals into establishing their own business due to lack of prospects of attaining a paid position. Since promoting unemployment is not a meaningful strategy of a policy that aims at raising the level of start-ups in order to stimulate the generation of new jobs, the unemployment rate is not included into the models in table 2.4. As in the models for the level of regional start-ups (table 2.3), the models control for spatial autocorrelation by including the mean residual of the adjacent regions. Again, all models are estimated by pooled regression and by applying a fixed-effects estimator.

As in the analyses for the level of start-ups, the level of R&D employment and the level of employment in small and young businesses have a positive effect on an increase of regional new business formation activity (table 2.4). Apparently, high levels of regional innovation and entrepreneurship fuel new business formation processes. This can also be observed for an increase of R&D employment and an increase of employment in small and young businesses. The negative coefficient for the lagged start-up variable indicates that if the level of start-up activity has been relatively high in a certain period, it is more likely to decrease instead of increase in the next period. While population density has a statistically significant negative effect on the development of the start-up rate, the coefficient for gross value added per labor force shows a positive sign indicating that a high regional wealth level may stimulate start-ups. The impact of changes of gross value added is non-significant or significantly negative. Obviously, an increase in regional demand hardly affects an increase in start-up activity.

Table 2.5 Determinants of changes of the number of start-ups

	Percent change of number of start-ups			
	Pooled regression		Panel fixed-effects regression	
	(I)	(II)	(III)	(IV)
Share of R&D personnel (change over 5 years, %)	0.133** (4.62)	0.135** (4.80)	0.118** (2.80)	0.077 (1.75)
Share of employees in small and young firms (change over 5 years, %)	0.208** (7.16)	0.223** (7.86)	0.272** (6.50)	0.207** (4.90)
Share of R&D personnel (t–1)	0.006 (1.49)	0.009** (2.89)	0.165** (6.00)	0.165** (5.81)
Share of employees in small and young firms (t–1)	0.035** (10.11)	0.032** (9.02)	0.028** (3.04)	0.027** (2.92)
Log population density (t–1)	–0.031** (6.47)	–0.023** (4.88)	–0.342 (1.09)	0.633* (2.13)
Gross value added per labor force (t–5)	0.140** (3.62)	–	0.303** (4.06)	–
Change gross value added over 5 year period (t–5)	–	–0.001 (1.27)	–	–0.006** (8.33)
Start-up rate (t–5)	–0.048** (13.84)	–0.044** (12.63)	–0.141** (20.20)	–0.141** (19.60)
Spatial lag (error)	1.029** (39.95)	1.051** (41.05)	1.067** (31.26)	1.067** (26.54)
Constant	–1.308** (3.08)	0.226** (6.82)	–1.146 (0.73)	–2.942 (1.82)
R^2-adjusted	0.8023	0.8073	0.7918	0.7809
F-value	300.87	310.55	291.02	273.48
Observations	592	592	592	592

Notes: ** significant at 1%-level, * significant at 5%-level, t-values in parentheses.

Based on these estimates, it can be concluded that many of the variables that influence the level of new business formation activity in a region also have an effect on the change of entrepreneurial activity. The main factors that lead to an increase in start-up activity are regional innovativeness and the already existing level of entrepreneurship. A high regional level of unemployment may also force more individuals to start a business and lead to an increase in start-ups. A change in gross value added does not prove to stimulate new business formation activity. This implies that regional new business formation activity is mainly driven by factors on the supply side and not by regional demand.

2.5 Discussion and Policy Implications

There are great differences between regional start-up rates, and it is quite likely that these differences have considerable consequences for regional development, particularly in the long run. The level of regional new business formation activity shows a pronounced degree of persistence and path-dependency over time. Regions with relatively high entry-rates in the past are most likely to experience high level of start-up activity in the future. Correspondingly, regions with a low level of new businesses today are 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 a long time period, and they are in most cases 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. According to the results, it appears quite likely that the main benefits of such a policy will arise only for future generations but not for the current one.[6]

The analyses of the factors that determine the level and the development of regional new business formation clearly indicate a strong influence of the entrepreneurial culture and the level of innovation activity in a region. These two issues constitute the main starting points for a policy, which aims to enhance new businesses formation in certain regions. Having identified these two fields of action the question arises how the entrepreneurial culture and the level of innovation activity could be appropriately stimulated. What is the scope and what are the right measures for such a policy? There are no ready answers to such questions. It is well known, however, that regions are rather different and that different regional growth regimes may be identified (Audretsch and Fritsch, 2002; Fritsch, 2004; Fritsch and Mueller, 2005a, 2006) in which the level as well as the character of entrepreneurship may differ considerably (see contributions in Fritsch and Schmude, 2006). This suggests that development strategies and policy measures should account for region-specific

6 Perhaps, this conclusion should be qualified by pointing out that the effects of public policy programs, that are aiming at promoting start-ups in certain regions, were not investigated. Therefore, the finding that changes of the regional level of new business formation activity are small and slow should not be misconceived as an evaluation of the effectiveness of such policies. As far as such policies have been in operation, however, they did not lead to any fast and large changes of the level of regional new business formation activity in the time-period under review.

factors (Lundström and Stevenson; Howells, 2005; Toedtling and Trippl, 2005). Despite the fact that entrepreneurship is strongly shaped by regional factors, one should acknowledge that a number of factors, which may have a significant impact on the level of entrepreneurial activity, are mainly decided on the national level, consequently they hardly differ between regions (Audretsch et al., 2002). The issues stimulating or hampering entrepreneurship concern tax and welfare arrangements as well as the general economic development (van Stel and Stunnenberg, 2004). A high level of ownership taxation could considerably reduce the propensity to start an own business. Likewise, generous unemployment benefits and other social welfare arrangement may weaken the incentive to be an entrepreneur (Verheul et al. 2002).

A discussion of possible policy measures for promoting entrepreneurship and start-ups should not solely focus on the quantity of start-up but also account for their quality. Obviously, a maximization of the number of start-ups is not a meaningful strategy (Greene et al., 2004). Moreover, policy should not neglect that large businesses could make a significant contribution to regional development. Innovative incumbent firms may serve as an incubator of new businesses by providing a seedbed for spin-offs (Klepper and Sleeper, 2005; Agarwal et al., 2004; Klepper, 2001; Sorenson, 2003). It may, indeed, be crucial for regional development to have a balanced combination of both small businesses and incumbent enterprises. Nevertheless, it is still rather unclear how such a policy can be put into practice. Therefore, considerable further research regarding appropriate entrepreneurship policy is necessary to develop appropriate strategies. If entrepreneurship capital is an important determinant for growth, it is necessary to learn more about ways in which it can be created.

3 Effects of New Business Formation on Regional Development over Time*

3.1 Introduction

Does a high level of new business formation in a region stimulate economic development?[7] While most people believe this is the case, a clear and indisputable empirical proof for the hypothesis is still lacking. Some results of recent research suggest that the unclear evidence concerning the relationship between the level of new business formation and employment growth could be attributed to long time lags that are needed for the main effects of the entry of new entities to become evident. In their analysis of the relationship between new business formation and employment growth in West German planning regions, Audretsch and Fritsch (2002) found that start-ups that occurred in 1983–1985 could contribute to explaining employment change in 1993–1998. Van Stel and Storey (2004), in an investigation of the relevance of such time lags for British regions, arrived at the conclusion that the strongest employment effect can be attributed to new business formation activity that occurred about 5 years earlier.

The present chapter investigates the time lag of the effect of new business formation on regional employment growth for West Germany. As a starting point, section 3.2 reviews the possible direct and indirect effects of the set-up of new businesses on regional development. Section 3.3 then provides an overview of the empirical evidence and section 3.4 deals with data and measurement issues. Results concerning the time lag distribution of the effects that new firm formation has on regional employment are reported in section 3.5. The final section discusses implications of the findings for public policy and proposes some issues for further research.

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* This chapter is based on Fritsch and Mueller (2004). This chapter has greatly benefited from suggestions and comments made by Zoltan Acs, David Audretsch, David Storey, André van Stel, Gerd Ronning and participants at the Conference of the Schumpeter Society in 2004.

7 This chapter uses the term *new businesses* as the overall category for both new firms and new plants because the database does not make a distinction between these two categories.

3.2 Possible Effects of New Business Formation on Regional Growth

The relationship between new businesses and economic development is quite complex. Analyzing this relationship requires a comprehensive approach that should include more than the development of employment in the new units and should particularly account for the related supply-side effects. Figure 3.1 presents the different types of impacts that new firm formation can have on economic development. New businesses represent an entry of new capacities into the market and are therefore an essential element in the market process.

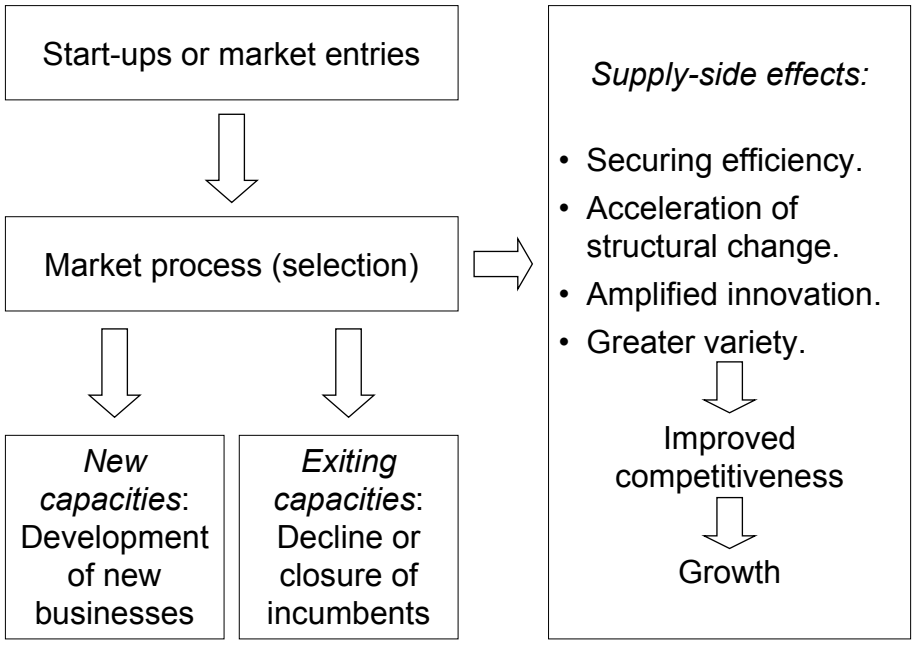

Figure 3.1 New business formation and the market process

One contribution that new businesses make to economic development is found in the evolution of the newcomers, which may be called the *direct effect* of new capacities. Two types of exits can result from the entry of new capacities. First, there are new businesses that fail to be sufficiently competitive and thus have to leave the market after some time. Second, there is the crowding out of incumbents by their new competitors, which leads to declining market shares or market exit. Further effects that are rather indirect in nature result from intensified competition due to entry and pertain to the supply-side of the market. There are four main kinds of such *indirect supply-side effects* resulting from new firm formation:

- *Securing efficiency*. Newcomers contest established market positions. Not only the actual entry, but also the very possibility of entry forces the incumbents to behave more efficiently (Baumol et al., 1988).

- *Acceleration of structural change*. It can frequently be observed that structural change is accomplished by a turnover of the respective economic units, i.e. by entries of new businesses joined by exits of incumbents. In this case, the incumbents do not undergo necessary internal changes, but are substituted by newcomers.[8] This type of process has been put forward by Schumpter's (1911, 1942) concept of creative destruction and by Marshall's (1920) analogy of a forest in which the old trees must fall to give way to the new ones.

- *Amplified innovation*. Entries may, particularly, create new markets. There are many examples of radical innovations that have been introduced by new firms (Acs and Audretsch, 1990; Audretsch, 1995). One major reason for this pronounced role of new firms in introducing innovation could be that incumbent suppliers are more interested in exploiting the profit possibilities of their given product program than they are in searching for new opportunities (Geroski, 1995: 431). Another explanation could be that to set up one's own business might appear to be the only or the most promising possibility to commercialize knowledge (Audretsch, 1995).

- *Innovative entry*. Newcomers may lead to a greater variety of products and problem solutions. If the product programs of the newcomers differ from those of the incumbent firms, or if they introduce significant process innovation, this leads to the availability of a larger spectrum of goods and problem-solving methods. Such an increased variety implies a higher probability of finding a supply with a better match for customer preferences than the supply available beforehand. Increased variety due to new supplies may stimulate an intensified division of labor as well as follow-up innovation and in this way can generate significant impulses for economic development.

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8 Such a process could, for example, be observed in the transformation of former socialist economies of Central and Eastern Europe where new firms had a considerably stronger impact on structural change (Brezinski and Fritsch, 1996; Pfirrmann and Walter, 2002).

These supply-side effects of the new business formation process augment the regional knowledge stock and can lead to significant improvements in the competitiveness of an economy, industry or region. In this indirect way, new business formation processes may stimulate economic growth.

While the direct impact of new business formation on employment, namely the setting up of new capacities, is positive by definition, the net effect in terms of employment in new capacities minus employment in exiting capacities may well be negative. Such a negative net effect of market entry on employment can be expected if the market mechanism results in a *survival-of-the-fittest* scenario while the market volume remains constant. In this case, the surviving firms will provide a given amount of output more efficiently than before and, insofar as labor productivity rises, this implies less employment. However, while such a labor-saving effect of increased efficiency may occur, it also concurrently results in improved competitiveness which may lead to rising output. Such a labor-saving effect can be regarded favorable from a growth perspective because it provides resources for growth in other markets. It follows that with a well-functioning selection mechanism, an increase of employment can mainly be expected from growth induced by the supply-side effects of the new firm formation process. The magnitude of these supply-side effects should depend on the quality of the newcomers as well as on the efficiency of the market process. Quality of newcomers in this context means their competitiveness and thus the challenge they pose to the incumbents. A main determinant of this challenge is their innovativeness, e.g., to what degree their supply is of a new or higher quality or is produced with lower costs than that of the incumbents.

The efficiency of the market process with regard to the effects of entries can be judged according to the following two criteria:

- How quickly and how intensely do the incumbents react to an actual or a potential entry?
- How reliably does the market mechanism discriminate between the better and the inferior solution, i.e. how far does the selection by competition result in a survival-of-the-fittest scenario?

According to these criteria, the market process can be judged to be more efficient the more reliably a superior solution turns out to be economically successful. In the case that the market selection process favors an inferior alternative, no competitiveness-increasing supply-side effects will emerge. Two issues must be considered with regard to the speed and intensity of the reaction of incumbents. On the one hand, market processes should be fast so that improvements become effective without unnecessary delay. On the other hand, anticipation of a more or less immediate reaction of the incumbents may deter entries and result in a relatively low level of new firm formation. Particularly if innovative newcomers have to expect rather speedy imitation of their advancement, this will reduce their expected profit and therefore also diminish the incentive for innovative entry. Therefore, market entry and its associated effects on economic development depend on the selection mechanism, which may foster or hamper the innovative success of new businesses.

The emergence of the supply-side effects of new business formation does not necessarily require the newcomers to be successful. As long as entry induces improvements on the side of the incumbents, it will generate positive supply-side effects, even if the new businesses fail and have to exit the market soon after entry. As far as the overall outcome of the supply-side effects is concerned, it is irrelevant whether the improved supply is provided by the newcomers or by the incumbents. Therefore, even the failed start-ups can make a significant contribution to the improvement of supply and competitiveness. Insofar as competition leads to a survival-of-the-fittest scenario, one could expect that high turnover in the stock of firms or establishments results in relatively large improvements of supply and competitiveness (for a review of the evidence, see Caves, 1998). A high probability of failure could, however, have a negative effect if it was to discourage potential market entry, thereby resulting in the situation that a certain kind of innovation does not occur.

A main problem related to the empirical assessment of these outcomes is the correct identification of the various indirect effects. This is particularly difficult because such indirect effects, like the exit of an incumbent competitor or an improvement of their supply, may not necessarily occur in the same region or even country where the new business was founded. Since an innovation can also be applied in other industries, it may well have an impact outside the industry of origin. An analy-

sis that measures only the effects of new business formation within the respective industry or region is therefore incomplete and will underestimate the total impact. Due to these problems in identifying the diverse indirect effects, a comprehensive assessment may be impossible. This holds particularly true for long-term effects on the supply-side that become effective only after a considerable time lag. Therefore, any measurement of the indirect effects of new business formation on economic development will be incomplete.

3.3 Review of the Evidence

The empirical evidence regarding the impact of new business formation on economic development is somewhat diffuse. One reason for the mixed results may be that different indicators for market dynamics as well as for economic development are used. While some studies examine the effects of entries and exits separately, others use such measures as independent variables that combine the information on entry and exit to describe the turnover of firms in an industry or region. A frequently used turnover measure is turbulence, i.e. the sum of entries and exits. Another indicator of this type is net entry, which is understood as entries minus exits. Common measures for economic development are changes in employment, unemployment, value added of production, and productivity. A number of studies are limited to specific sectors such as manufacturing, and some compare different sectors. Only a small number of studies analyze regions or countries.

One way of assessing the impact of new firms on economic performance is to estimate the contribution of entries and exits on productivity (Baldwin, 1995; Disney et al., 2003; Foster et al., 2001; for a review, see Caves, 1998). A standard result of this type of analysis is that a considerable part of the productivity improvement can be attributed to the entrants with above-average productivity and the exit of businesses with relatively low productivity. A significant portion of improvements in productivity is due to the turnover of units and takes place within multi-plant firms that close down low-productivity plants and set up highly efficient new ones (Disney et al., 2003).

Most studies with regions as units of analysis relate the regional entry rate to employment change or to unemployment. A considerable number of these studies are

restricted to the headquarters of new firms and do not take into account new plants. A clear positive impact of new business formation on employment has been found in studies about the United States (Acs and Armington, 2004; Reynolds, 1994, 1999). However, the magnitude of the relationship seems to vary over time. Empirical proofs of a clear positive relationship in other countries are relatively rare (for an overview, see Carree and Thurik, 2003: 457–463). Ashcroft and Love (1996) detected evidence that entrepreneurship had a positive effect on employment change in Great Britain in the 1980s. Davidsson et al. (1994a, 1994b) identified some impact of regional new business formation in Sweden on a complex indicator for economic well being. Studies about Sweden by Fölster (2000) and Braunerhjelm and Borgman (2004) found a positive impact of increased self-employment rates on regional employment.[9] Brixy (1999) showed that new business formation had a strong positive effect on regional employment in East German regions in the first years of the transformation process. However, analyses about the Netherlands (EIM, 1994) and about West Germany (Audretsch and Fritsch, 1996; Fritsch, 1996, 1997) did not find such a relationship for the 1980s.

Audretsch and Fritsch (2002) suggested that the lack of clarity with regard to the impact of new business formation on regional development may be attributed to relatively long time lags that are required for the main effects of the new entries to become evident. They found that the level of start-ups in the 1980s could not contribute to explaining employment change in the 1980s, but could explain changes in the 1990s. Van Stel and Storey (2004), in their analysis for British regions, investigated the relevance of such time lags somewhat more systematically. They confirmed that the regional growth rate was positively shaped by new firm formation from several of the earlier periods. According to their results, the magnitude of the effects over time took the form of an inverse U-shape with a peak for the start-up activity from five years earlier. After ten years, no effect of new firm formation on regional employment could be identified. Audretsch and Keilbach (2004a) analyzed the impact of the regional level of entrepreneurship on economic output in West German regions in the framework of a production function and found a positive im-

9 These two studies used the share of self-employed firms without any additional employees as measure for the level of entrepreneurship in a region assuming that this measure might indicate the share of recently established firms.

pact that was quite pronounced. Because their analysis was only for one year, they could not examine the significance of a time lag in the relationship.

Audretsch et al. (2001) investigated the impact of changes in self-employment on unemployment for 23 Organization for Economic Co-operation and Development (OECD) countries on a national level.[10] While they found some unemployment-reducing effects of increased self-employment, their analysis also showed that such a relationship does not hold true for all of the countries in their sample. Remarkably, the effect tends to be larger for longer time spans. Regressions with change of unemployment and entrepreneurship measured over eight years show a stronger relationship between these indicators than do regressions for values calculated over four years. If calculations are based on twelve years, the impact of changes of self-employment on the unemployment rate becomes even more pronounced.

A number of studies analyzing the effect of turbulence on regional productivity also found positive effects (Callejón and Segarra, 1999; Bosma and Nieuwenhuijsen, 2002). If the impact of entry or turbulence is investigated for the large economic sectors separately, the effect found in services often tends to be somewhat stronger than that in manufacturing, where it may not even be statistically significant (Acs and Armington, 2004; Bosma and Nieuwenhuijsen, 2002). This supports Geroski's (1995) assessment that new firm formation does not appear to play an important role for the economic performance of manufacturing industries.

It is concluded from the available evidence that there is a positive impact of new business formation on economic development and that there may nevertheless be considerable time lags involved. However, the magnitude of the overall effect as well as the length and the structure of this time lag remain unclear.

3.4 Data and Measurement Approach

The present data on new business formation and regional development of employment are from the establishment file of the German Social Insurance Statistics (for a

10 Unemployment might be a quite problematic indicator for the effect of new firm formation or self-employment on economic development because it is shaped by demographic factors such as the age of the work force, development of labor force participation rates and mobility between regions or countries.

description, see Fritsch and Brixy, 2004). This database provides information about all establishments with at least one employee subject to obligatory social insurance. Currently, the information on West Germany is available yearly for a relatively long period of 20 years, from 1983 to 2002. Because the database records only businesses with at least one employee, start-ups consisting only of owners are not included. New businesses are excluded with more than 20 employees in the first or second year of their existence; as a result, a considerable number of new plants of large firms contained in the database are not counted as start-ups. Although the database only includes information at the establishment level, comparison with information on the regional distribution of headquarters of newly founded firms reveals a rather high correlation, thus allowing the data to also be regarded as an indicator for regional entrepreneurship (Fritsch and Brixy, 2004; Fritsch and Grotz, 2002).

Other data used in the analysis are from publications of the German Federal Statistical Office. The analysis is restricted to West Germany for two reasons. First, many studies indicate that East Germany was a special case in the 1990s with very specific conditions that cannot be directly compared with West Germany (Brixy and Grotz, 2004; Fritsch, 2004). Secondly, in order to determine the indirect effects of new business formation, one relies on a long period for West Germany for which data are not existent for East Germany. Furthermore, the Berlin region was excluded due to changes in the definition of that region during the inspected period. The spatial units of analysis are the 326 West German *Kreise* (districts). Districts can be quite different in character: some are core cities, others are part of an agglomeration's suburban ring, and some comprise the core of a smaller city as well as the surrounding area. The advantage of choosing districts as spatial units of analysis is that the sample contains a larger number of cases that allows for more sophisticated empirical analyses. A severe disadvantage could be that certain influences prove relevant for larger spatial units than districts, resulting in autocorrelation across regional borders. Indeed, quite a considerable degree of spatial autocorrelation was found that was explicitly accounted for in the analysis.

The indicator for regional development is relative employment change (percentage) in the private sector. To avoid disturbances by short-run fluctuations, change rate over 2 years is used as the dependent variable (employment of $t+2$ relative to

employment in *t*). Variables for new business formation activity are the yearly start-up rates calculated according to the *labor market* approach, i.e. the number of start-ups per period is divided by the number of persons in the regional workforce at the beginning of the respective period (Audretsch and Fritsch, 1994a). An important adjustment was made to control for the fact that not only does the composition of industries differs considerably across regions, but also that the relative importance of start-ups and incumbent enterprises varies systematically across industries. For example, start-up rates are higher in the service sector than in manufacturing industries. This means that the relative importance of start-ups and incumbents in a region is confounded by the composition of industries in that region. This would result in a bias of overestimating the level of entrepreneurship in regions with a high composition of industries where start-ups play an important role, and underestimating the role of new business formation in regions with a high composition of industries where start-ups are relatively unimportant.

In order to correct for the confounding effect of the regional composition of industries on the number of start-ups, a shift–share procedure was employed to obtain a sector-adjusted measure of start-up activity (for details, see Audretsch and Fritsch, 2002). This sector-adjusted number of start-ups is defined as the number of new businesses in a region that could be expected if the composition of industries was identical across all regions. Thus, the measure adjusts the raw data by imposing the same composition of industries upon each region. Analysis shows this procedure leads to somewhat clearer results and higher levels of determination than do estimations using the non-adjusted start-up rate. However, the basic relationships are left unchanged.

Panel estimation techniques were used that allowed accounting for unobserved region-specific factors. Application of the Huber–White method provided robust standard error estimates. To analyze the impact of new business formation on regional employment change, the yearly start-up rates at the beginning of the inspected employment change periods (current year) and for the ten preceding years were included.

Table 3.1 Correlation matrix of sector-adjusted start-up rates for subsequent time periods

	Start-up rate in different years									
	t	t–1	t–2	t–3	t–4	t–5	t–6	t–7	t–8	t–9
t	1.00									
t–1	0.90	1.00								
t–2	0.84	0.89	1.00							
t–3	0.83	0.84	0.90	1.00						
t–4	0.85	0.85	0.87	0.91	1.00					
t–5	0.84	0.85	0.85	0.87	0.93	1.00				
t–6	0.83	0.83	0.84	0.86	0.92	0.93	1.00			
t–7	0.83	0.82	0.83	0.85	0.91	0.92	0.93	1.00		
t–8	0.84	0.83	0.81	0.83	0.90	0.91	0.92	0.93	1.00	
t–9	0.83	0.83	0.82	0.82	0.89	0.90	0.91	0.92	0.93	1.00
t–10	0.79	0.82	0.83	0.83	0.89	0.89	0.90	0.91	0.92	0.93

Notes: All coefficients are statistically significant at 1%-level.

A rather strong correlation was found between start-up rates of subsequent years (see table 3.1). To cope with this strong correlation, Almon polynomial lags were applied to estimate the time lag structure of the effect of new firm formation on regional employment change (for a detailed description of this method, see Greene, 2003). Population density as a proxy for regional characteristics such as the availability of qualified labor, housing prices, local demand, and the level of regional knowledge spillovers did not prove to have any statistically significant effect and was therefore not included. However, when the model was estimated for agglomerations, moderately congested areas and rural regions separately[11], differences in the magnitude of effects were found.

3.5 Distribution of Time Lags

To shed light on the lag structure of the effect of new business formation on regional employment change, the first model included the start-up rate at the beginning of the inspected period of employment change (current year) and all start-up rates of the preceding ten years. Because of a relatively high level of correlation between the start-up rates of subsequent years, the impact of each lagged start-up rate was also analyzed separately (table 3.2).

11 See the Federal Office for Building and Regional Planning (2003) for the definition of the type of region.

Table 3.2 Impact of new business formation on regional employment change (Robust Huber-White estimator)

	Two year regional employment change (%)											
Constant	–1.28** (3.13)	–0.47* (1.98)	–0.26 (1.10)	–0.72** (3.00)	–0.91** (3.83)	–1.01** (4.13)	–1.22** (4.88)	–1.67** (6.52)	–2.22** (8.12)	–2.62** (9.36)	–2.17** (7.25)	–1.06** (3.09)
Start-up rate current year t	0.55** (6.65)	0.25** (9.75)	-	-	-	-	-	-	-	-	-	-
Start-up rate year t–1	–0.29** (5.12)	-	0.23** (9.23)	-	-	-	-	-	-	-	-	-
Start-up rate year t–2	0.06 (0.78)	-	-	0.29** (11.04)	-	-	-	-	-	-	-	-
Start-up rate year t–3	–0.31** (4.07)	-	-	-	0.31** (11.57)	-	-	-	-	-	-	-
Start-up rate year t–4	–0.48** (6.60)	-	-	-	-	0.31** (11.27)	-	-	-	-	-	-
Start-up rate year t–5	–0.16* (2.28)	-	-	-	-	-	0.32** (11.50)	-	-	-	-	-
Start-up rate year t–6	0.31** (3.95)	-	-	-	-	-	-	0.32** (11.63)	-	-	-	-
Start-up rate year t–7	0.35** (4.73)	-	-	-	-	-	-	-	0.31** (10.57)	-	-	-
Start-up rate year t–8	0.13* (1.93)	-	-	-	-	-	-	-	-	0.29** (9.87)	-	-
Start-up rate year t–9	–0.03 (0.40)	-	-	-	-	-	-	-	-	-	0.24** (7.43)	-
Start-up rate year t–10	0.02 (0.26)	-	-	-	-	-	-	-	-	-	-	0.15** (4.08)
Spatial autocorrelation (residuals in adj. regions)	0.48** (8.01)	0.79** (31.44)	0.80** (31.57)	0.81** (31.69)	0.81** (30.74)	0.81** (30.24)	0.81** (29.90)	0.80** (29.76)	0.72** (19.45)	0.64** (15.25)	0.66** (15.69)	0.63** (14.02)
R^2	0.16	0.41	0.41	0.44	0.44	0.44	0.45	0.43	0.30	0.21	0.22	0.18
F-value	32.41	543.19	536.87	546.29	514.40	508.30	506.74	529.50	278.70	175.35	154.08	105.92
Observations	2,608	5,868	5,542	5,216	4,890	4,564	4,238	3,912	3,586	3,260	2,934	2,608

Notes: Robust Huber-White estimates; ** statistically significant at 1%-level; * statistically significant at 5%-level, t-values in parentheses.

Table 3.3 Impact of new business formation on regional employment change (Fixed-effect estimator)

	Two year regional employment change (percentage)											
Constant	–17.26** (7.32)	–1.44** (4.47)	–0.77* (2.19)	–1.44** (3.06)	–0.83 (1.66)	–0.28 (0.52)	–0.47 (0.81)	–0.72 (1.19)	–1.27 (1.95)	–2.70** (3.91)	–2.73** (3.73)	–0.86 (1.05)
Start-up rate current year t	0.82** (13.09)	0.38** (10.01)	-	-	-	-	-	-	-	-	-	-
Start-up rate year t–1	–0.21** (3.06)	-	0.12** (2.92)	-	-	-	-	-	-	-	-	-
Start-up rate year t–2	0.44** (4.00)	-	-	0.39** (6.79)	-	-	-	-	-	-	-	-
Start-up rate year t–3	–0.05 (0.51)	-	-	-	0.30** (4.97)	-	-	-	-	-	-	-
Start-up rate year t–4	–0.30** (2.91)	-	-	-	-	0.22** (3.41)	-	-	-	-	-	-
Start-up rate year t–5	0.01 (0.10)	-	-	-	-	-	0.23** (3.25)	-	-	-	-	-
Start-up rate year t–6	0.52** (5.17)	-	-	-	-	-	-	0.21** (2.85)	-	-	-	-
Start-up rate year t–7	0.55** (5.56)	-	-	-	-	-	-	-	0.20* (2.49)	-	-	-
Start-up rate year t–8	0.19 (1.88)	-	-	-	-	-	-	-	-	0.30** (3.63)	-	-
Start-up rate year t–9	0.01 (0.07)	-	-	-	-	-	-	-	-	-	0.31** (3.49)	-
Start-up rate year t–10	0.11 (1.04)	-	-	-	-	-	-	-	-	-	-	0.13 (1.27)
Spatial autocorrelation (residuals in adj. regions)	0.44** (12.67)	0.80** (63.90)	0.81** (61.81)	0.82** (63.37)	0.82** (61.36)	0.82** (59.61)	0.82** (57.80)	0.82** (53.48)	0.73** (37.36)	0.64** (25.74)	0.67** (26.45)	0.64** (22.75)
R^2	0.04	0.38	0.38	0.41	0.42	0.42	0.42	0.40	0.27	0.19	0.19	0.15
F-value	43.63	2059.30	1918.94	2011.35	1890.32	1779.41	1672.70	1432.02	703.36	345.96	358.91	258.89
Observations	2,608	5,868	5,542	5,216	4,890	4,564	4,238	3,912	3,586	3,260	2,934	2,608

Notes: Estimates with fixed-effects; ** statistically significant at 1% level; * statistically significant at 5%-level, t-values in parentheses.

When including all start-up rates in one model, the highest positive impact for new business formation of the current year and of the years *t–6* and *t–7* were found, i.e. the start-up rates of six and seven years ago. Remarkably, the start-up rates of periods *t–3* and *t–4* have a significantly negative impact on employment change. Thus, the results of the regression including all relevant start-up rates between *t* and *t–10* indicate both a positive and a negative relationship between entrepreneurial activity and employment growth (figure 3.2). Such negative employment effects could result from exiting capacities and improved efficiency in the regional provision of goods and services due to market selection. However, when running separate regressions for each start-up rate, it was found that there was always a significantly positive relationship between new business formation and regional employment change. The separate regressions with the single start-up rates show the strongest impact for the start-up rates of years *t–5* and *t–6*. The impact of start-ups on employment change first increases and then decreases with rising time lags from the period to which the dependent variable is related. Apparently, the impact of new business formation on regional employment change fades away with the years. In the regression that includes all lagged yearly start-up rates between, the coefficients for the start-up rates of the most distant years (*t–9* and *t–10*) are not statistically significant.

Spatial autocorrelation was accounted for in two different ways (Anselin, 1988; Anselin and Florax, 1995). First, an average of the residuals in the adjacent regions was included that could be an indication of unobserved influences that affect larger geographical entities than districts and that are not entirely reflected in the explanatory variables (table 3.2). Second, spillover effects when measured as an average of the employment change in the adjacent districts were employed to account for determinants of employment change not limited to the particular region. Both indicators of spatial autocorrelation resulted in the same lag structure, yet the magnitude of the positive effects was stronger in the regressions that included the residuals of adjacent regions as a measure of spatial autocorrelation. As an alternative estimation method to the Huber–White method, the model with fixed effects regression was applied (table 3.3 and table 3.5). The differences in the results when using the robust standard error estimates are more or less gradual. The lag structure remains the same

in the fixed-effects model; however, the magnitude of the impact of new business formation on regional employment change was slightly stronger.

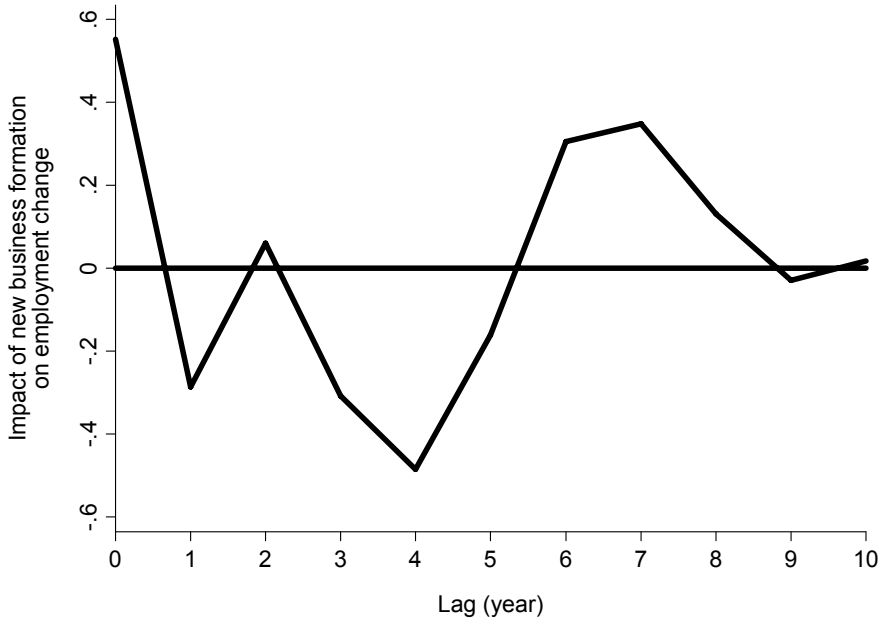

Figure 3.2 *Structure of the impact of new business formation on regional employment growth based on a regression that accounts for entry rates over eleven years*

The pronounced multicollinearity of the start-up rates makes the interpretation of the regression coefficients problematic. Due to the observed high correlation of start-up rates in subsequent years, the regression coefficient for a certain year may not necessarily reflect the impact of start-up activity not only in this specific year, but also in other years. Almon polynomials were applied to cope with this problem (for a similar approach, see van Stel and Storey, 2004). This method reduces the effects of multicollinearity in distributed lag settings by imposing a particular structure on the lag coefficients. It is assumed that the effect of changes in yearly start-up rates will be distributed over eleven years because regression analyses of lagged start-up rates suggested that the impact on employment change has more or less faded away after that period (table 3.2).

Table 3.4 Impact of lagged start-up rates on regional employment change

	Two year regional employment change (percentage) Almon method assuming a polynomial of			
	Second order	Third order	Fourth order	Fifth order
Constant	–1.21** (3.06)	–1.19** (2.95)	–1.21** (2.99)	–1.20** (2.96)
Start-up rate current year	0.16	0.42	0.48	0.44
Start-up rate year t–1	0.06	–0.03	–0.09	–0.02
Start-up rate year t–2	–0.03	–0.25	–0.31	–0.30
Start-up rate year t–3	–0.08	–0.30	–0.31	–0.36
Start-up rate year t–4	–0.11	–0.22	–0.19	–0.23
Start-up rate year t–5	–0.12	–0.07	–0.02	–0.02
Start-up rate year t–6	–0.09	0.09	0.12	0.18
Start-up rate year t–7	–0.04	0.22	0.20	0.25
Start-up rate year t–8	0.03	0.26	0.20	0.18
Start-up rate year t–9	0.13	0.16	0.10	0.03
Start-up rate year t–10	0.25	–0.13	–0.06	–0.02
Spatial autocorrelation (residuals in adjacent regions)	0.60** (13.01)	0.52** (9.68)	0.51** (9.56)	0.51** (9.45)
R^2	0.18	0.16	0.16	0.16
F value	53.13	53.21	45.55	39.01
Observations	2,608	2,608	2,608	2,608

Notes: Robust Huber-White estimates; ** statistically significant at 1%-level; * statistically significant at 5%-level, t-values in parentheses.

A rather critical issue in applying the Almon lag procedure is determining which type of polynomial to assume. Table 3.4 has the results of the robust regressions when applying the Almon method with a polynomial lag of second, third, fourth and fifth order. Figure 3.3 is a graphical exposition of the estimated lag structures that results from the different types of polynomials assumed. It was found that a second-order polynomial results in a U-shape structure for the impact of new business formation on regional development. The results indicate that while the start-ups of the current period and of *t–1* have a positive impact, the effects of new businesses' set-ups in years *t–2* to *t–7* are negative. The entries of the last three years (*t–8* to *t–10*) have again an increasingly positive impact that is strongest for the last period (*t–10*). However, the rising strength of the effect of new businesses on regional development suggested by such a type of lag structure is not consistent with the observation from standard regressions (table 3.2), namely that this impact, after having reached a maximum, is becoming increasingly smaller over the years until it has faded away.

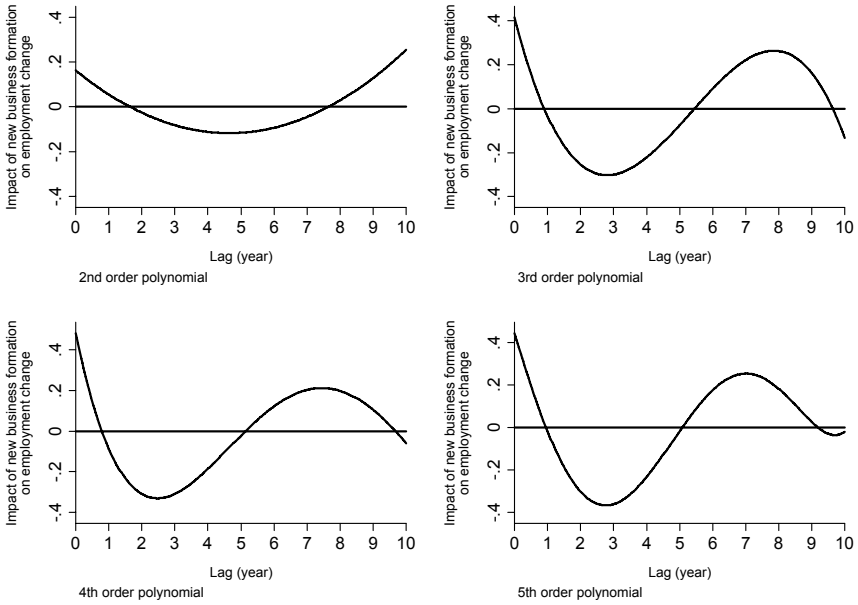

Figure 3.3 Lag structure of the impact of new business formation on regional employment growth

A third-order polynomial leads to the same type of lag structure that can also be found for fourth-and fifth-order polynomials. This pattern suggests that new business formation of the current year has a positive impact on employment change. For years *t–1* to *t–5*, the effect is negative with a minimum in *t–3*. For the entries in years *t–6* to *t–9*, a positive relationship is found with a maximum between *t–7* and *t–8*. The magnitude of the effect then decreases and is somewhat negative in the last year included (*t–10*). The relatively high *F*-value for the estimates applying a third-order polynomial indicates that this assumption fits the data rather well.

The pattern found for the lag distribution of the impact of new business formation on regional employment suggests a certain time sequence of the different effects detailed above. The positive employment impact for start-ups in the current year can be understood as the additional jobs created in the newly founded businesses at the time of inception. This direct employment effect is given by area I in figure 3.4. It is known from other analyses that employment in entry cohorts tends to be stagnant or declining from the second or the third year onward (Boeri and Cramer, 1992; Brixy and Grotz, 2004; Fritsch and Weyh, 2006). Therefore, new business formation in years *t–1*, *t–2* and in earlier years should not lead to any significant direct employment effect. As soon as a new business is set up, it is subject to market selection and

will perhaps gain market shares from incumbent suppliers. It may therefore be assumed that the negative impact of the start-ups in years *t–1* to *t–5* (figure 3.4, area II) results from exiting capacities, i.e. new businesses that fail to be competitive and from the crowding out of incumbents. The positive impact of new business formation for the years on employment, *t–6* to *t–10*, is probably due to a dominance of indirect supply-side effects, i.e. increased competitiveness of the regional suppliers resulting from market selection (figure 3.4, area III). After about nine or ten years, the impact of new businesses on regional employment has faded away.

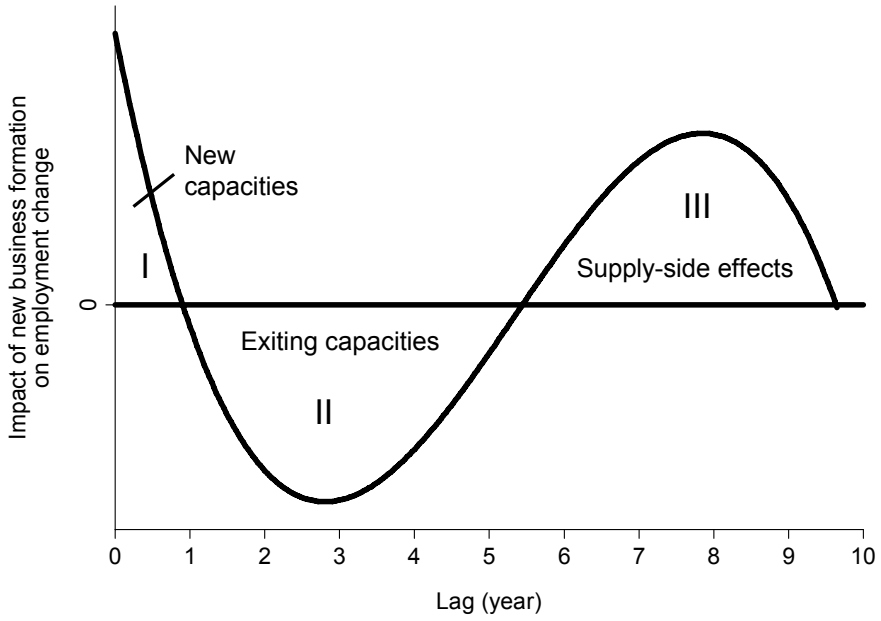

Figure 3.4 Direct and indirect effects of new business formation on employment change over time

If the interpretation of the lag structure is correct, the pattern implies that the employment gain due to indirect supply-side effects of new business formation is much larger than the initial employment created in the newly founded businesses, i.e. the direct employment effect. One indication for this conjecture is that according to the estimated coefficients, the area in figure 3.3 that represents the indirect supply-side effect is always larger than that of the initial employment effect. This is particularly clear if the supply-side effects are compared with the net effect of new capacities and exiting capacities given by area I minus area II in figure 3.4. Because one cannot account for those parts of the supply-side effects that occur in other regions, this type of impact is probably underestimated herein. However, if the true supply-

side effects are considerably larger than what has been estimated, it can be concluded that this effect is the most important result of new business formation for economic development. In addition, the crowding out effect is also likely to be underestimated because the decreasing output of incumbents might also occur in other regions or cross industry boundaries.

Estimates of variations of the model and for sub-samples arrived at some interesting results. For example, the impact of entrepreneurial activity on employment change for longer time lags was analyzed. Testing for 12-year lags showed plausible estimates only for a third-order polynomial. Results of models that assumed a 14-year lag were not very robust and partly implausible, which may be an effect of the relatively low number of observations that remain if such a long time lag is used. A common result of those alternative versions that led to plausible lag structures was that start-up activity in the current year and of years *t–7* to *t–9* had the strongest positive impact on employment change. Relative employment change, the dependent variable in the analysis, was also calculated for only 1 year, as well as over 3, 4 and 5 years. Results showed that the magnitude of the effects is the highest the shorter the period chosen for calculating the employment change. However, these differences decrease with the period taken for measuring employment change, so that the results of models for employment change calculated over three and four years are quite similar. The lag structure of the different models is rather akin.

Estimating the present model separately for high-density agglomerations, moderately congested regions and rural areas showed some variation according to population density (figure 3.5). The highest magnitude of effects for the agglomerations followed by the moderately congested regions and the rural areas, for which the effects are relatively weakly pronounced, were found. This result can be explained by the relatively intense competition in areas with a high density of economic activity. If this interpretation is correct, the high-density areas should be characterized by a relatively high level of competitiveness due to high entry rates and rigorous market selection. The present interpretation is supported by the analysis of Fritsch and Falck (2002), who found a positive relationship between the level of new business formation and population density. Moreover, Fritsch et al. (2004) also showed that survival rates of start-up cohorts are significantly lower in regions characterized by high entry

rates. Quite obviously, entry leads to intensified competition and selection. Similar to model I in table 3.4, the start-ups of year *t–8* exhibit the strongest positive affect employment for all three types of regions.[12]

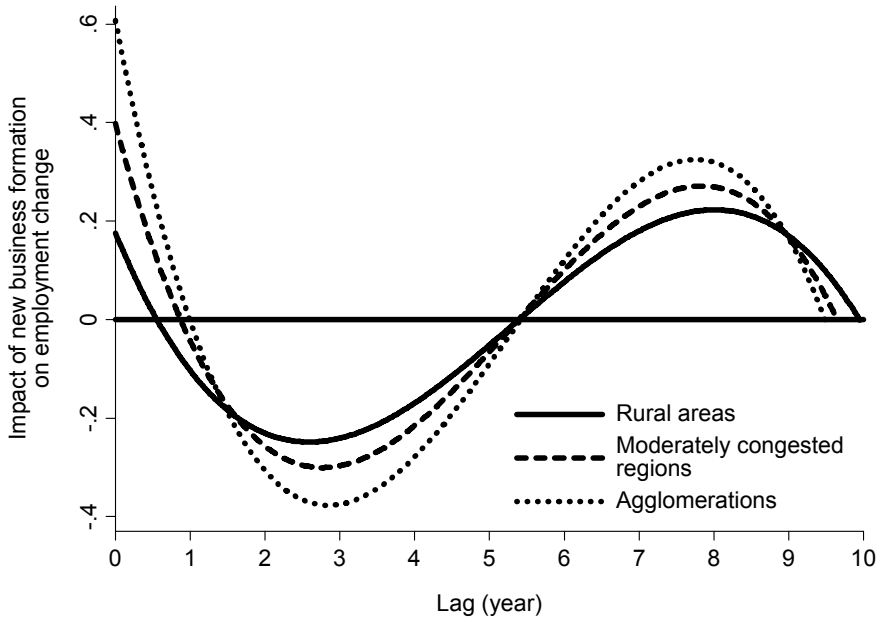

Figure 3.5 Effects of new business formation on employment change in different types of region

Estimating the models for start-ups and employment change in the manufacturing and the service sectors separately shows a much larger effect of new capacities (figure 3.4, area I) for manufacturing, which is probably due to the higher average size of entries in this sector. This contradicts Geroski's (1995) conjecture that entry is relatively unimportant for the performance of manufacturing industries. Negative employment effects due to exiting capacities occur earlier in the service sector than in manufacturing; in some of the models, they already appear in the year after start-up. This result corresponds to the relatively high hazard rates that can be observed for new service-sector businesses during the first years of their existence (Fritsch and Weyh, 2006; Fritsch et al., 2004). The supply-side effects in manufacturing were slightly less pronounced than in services. This is compatible with the observation that

12 Running the model for regions with both relatively high and low start-up rates separately did not show more pronounced effects in the region with a high level of new business formation. Obviously, it is the density and not the regional level of entry that makes the difference. The distribution of agglomerated regions, moderately congested regions and rural areas was not evidently different between the regions with high and low start-up rates.

markets for output of manufacturing establishments tend to be geographically larger than in the case of services, so that supply-side effects are less concentrated within the start-up region.[13]

To restrict the analysis to the long-term effects, only start-up rates of years *t–4* to *t–10* were included in regressions and a second-order polynomial was applied. This corresponds to the model used in the analysis of van Stel and Storey (2004). Interestingly, this results in an inverse U-shape lag structure that is quite similar to what was found by van Stel and Storey. In the present analysis, however, the highest positive impact of new businesses on employment is again found for the start-ups of years *t–7* and *t–8*. This is in contrast to the estimates of van Stel and Storey (2004), where the start-up rate of year *t*–5 has the strongest effect. To capture spillover effects, the impact of new business formation activity in adjacent regions was tested by including the start-up rates in these regions as independent variables.[14] The result revealed there to be a tremendous effect of start-ups in adjacent regions on a region's employment.

3.6 Final Discussion

This chapter has investigated the lag structure of the effect of new business formation on regional employment change. The results and interpretations clearly suggest that an analysis of the employment effects of new businesses that mainly focuses on the development of the entrants is inadequate. According to the present analysis, the indirect supply-side effects of entries are far more important than the amount of jobs directly created in the new businesses. As argued, it is not necessary that the new entities survive and exhibit strong growth in order for these supply-side effects to occur. The critical point is that improvements are made, whether on the side of the newcomers or on the side of the incumbents. Therefore, even those start-ups that fail

13 The effects of entries in either manufacturing or services on employment change in the private economy as a whole were also tested. The result showed quite similar long-term effects of new business formation and suggests its impact is not limited to the respective sector or industry.

14 New business formation activity in adjacent regions is calculated for each district by taking the average number of sector-adjusted start-ups in adjacent regions and dividing them by the average number of employees in adjacent regions. Almon polynomial lags were also applied to these start-up rates of adjacent regions.

to survive competition might make an important contribution. It is the contestability of markets that counts.

The results imply that the evolution of indirect supply-side effects of new business formation takes some time. Employment gains are rather modest in the year in which the new businesses are founded, and it is rather likely that these initial employment gains in subsequent years are more than compensated for by exiting capacities due to crowding out effects and failing newcomers. Therefore, the net employment effect of the entry processes over the first six or seven years might well be negative. New businesses do lead to more employment – but in the longer run. The magnitude of the different effects of start-ups on regional employment can vary according to the characteristics of the entrants and their competitors in the respective industry and region. Because highly innovative entry constitutes a greater challenge to the incumbents than non-innovative entry, one might expect larger supply-side effects for this type of entry. It is quite likely that this relationship is shaped by the type of technological regime that dominates in the respective industry and region (Audretsch, 1995: 39–64; Winter, 1984). In an entrepreneurial regime, it should be easier for newcomers seriously to challenge the incumbents than under the conditions of a routinized regime.

Obviously, the quality of market selection is of crucial importance for the emergence of the supply-side effects of new business formation likely to result in improved competitiveness and employment growth. Public policy should, therefore, safeguard the quality of this selection process and avoid everything that could disturb the survival-of-the-fittest scenario. This means, for example, that the failure of newcomers and market exits should be understood as necessary elements of market selection and that policy should abstain from subsidizing firms to prevent them from leaving the market. Moreover, stimulating and supporting entries should not result in unfair competition that jeopardizes the reliability of market selection. Such unfair competition might, for example, occur if entries are crowding out incumbents merely because they enjoy policy support. Instruments for the promotion of start-ups should be designed in a way that avoids such distorting effects.

Further research should try to achieve an in-depth understanding of the different effects of entry on market processes within different types of industries. Case studies could show to what extent the present argument concerning the different effects and the respective period is deemed accurate. Another important question that is of particular interest for policy concerns the magnitude of the indirect supply-side effects. What determines the size of these effects and their regional incidences? Which market conditions and what kind of selection processes are conducive to the supply-side improvements induced by entry? What could policy do to improve these effects? How should policies for stimulating start-ups be designed so that they do not impair the quality of market selection?

Table 3.5 Impact of lagged start-up rates on regional employment change (Fixed-effect estimator)

	Two year regional employment change (percentage)			
	Almon method assuming a polynomial of			
	Second order	Third order	Fourth order	Fifth order
Constant	–17.18** (7.54)	–14.99** (6.45)	–15.37** (6.59)	–15.26** (6.53)
Start-up rate current year	0.37	0.59	0.69	0.66
Start-up rate year t–1	0.28	0.16	0.09	0.14
Start-up rate year t–2	0.21	–0.04	–0.12	–0.12
Start-up rate year t–3	0.15	–0.09	–0.09	–0.14
Start-up rate year t–4	0.12	–0.02	0.04	0.00
Start-up rate year t–5	0.10	0.11	0.19	0.20
Start-up rate year t–6	0.10	0.25	0.30	0.34
Start-up rate year t–7	0.11	0.35	0.33	0.37
Start-up rate year t–8	0.15	0.36	0.27	0.26
Start-up rate year t–9	0.20	0.23	0.14	0.08
Start-up rate year t–10	0.28	–0.10	0.01	0.04
Spatial autocorrelation (residuals in adjacent regions)	0.61** (22.01)	0.52** (16.20)	0.51** (16.04)	0.51** (15.85)
R^2	0.05	0.05	0.05	0.05
F value	146.63	101.46	84.82	72.39
Observations	2,608 (8)	2,608 (8)	2,608 (8)	2,608 (8)

Notes: Fixed-effects estimates; ** statistically significant at 1%-level; * statistically significant at 5%-level, t-values in parentheses.

4 Exploring the Knowledge Filter: How Entrepreneurship and University-Industry Relationships Drive Economic Growth*

4.1 Introduction

It is important to understand why regions post different growth rates. Labor and physical capital certainly are important sources of economic growth, but knowledge creation, flows, and capitalization are also important elements in stimulating economic development. Recent empirical studies (Plummer and Acs, 2005; Acs and Varga, 2005; Audretsch and Keilbach, 2004a, b; Varga and Schalk, 2004) have shown that knowledge spillovers positively affect technological change and economic growth. An earlier study by Glaeser et al. (1992) found evidence that growth in cities is promoted by local competition and a great level of diversity. Entrepreneurship is a possible vehicle to increase the level of industrial diversity and to affect local competition by challenging incumbent firms. Historic industrial diversity promotes a diversified skill base which allows new high-tech industries to utilize these skills and profit from them (Henderson et al., 1995).

This chapter focuses on the commercialization of knowledge, which is understood as the transformation of knowledge into products, processes, and organizations and their contribution to regional economic growth. Different factors may explain why the degree of knowledge commercialization varies across regions. One explanation could be differences in the amount of research and development activities across regions. Research and development is crucial for the ability to identify, absorb, and exploit internally- and externally-generated knowledge created by other firms or research institutions (see Cohen and Levinthal, 1989). Therefore, a low level of research and development in a region may not just result in a lower level of absorptive capacity but also in a lower degree of knowledge exploitation in these regions.

* This chapter is based on Mueller (2006). This chapter has greatly benefited from comments and suggestions made by David Audretsch, Zoltan Acs, Werner Boente, Michael Fritsch, Vera Troeger and participants at the 5th Triple Helix Conference and ERSA Conference in 2005.

Another reason may be underexploited knowledge: incumbent firms do not exploit new knowledge to the full extent, or knowledge generated in research institutions and universities is hardly commercialized at all. Consequently, knowledge flows are necessary for other actors to exploit the new knowledge. Entrepreneurship and university-industry relations may function as mechanisms for knowledge flows as well as the commercialization of knowledge.

This chapter analyzes regional economic performance by using a production function approach similar to Audretsch and Keilbach (2004a). One contribution of this study is the examination of a cross-sectional time series, which allows controlling for unobserved heterogeneity between the regions. A second contribution is that university research and its utilization by private businesses are also considered. The results of the econometric analysis suggest that regions with a high level of entrepreneurship and university-industry relationships experience greater productivity, and consequently, economic growth. In particular, both start-ups in innovative industries and university research in engineering science foster economic growth. The remainder of this chapter is organized as follows. Section 4.2 presents the theoretical framework and links the channels of knowledge flows to economic performance. Section 4.3 describes the methodology and database. The relationship between economic performance and entrepreneurship and university-industry relations is empirically tested in section 4.4. Section 4.5 provides a summary and a conclusion.

4.2 The Capitalization of Knowledge and the Importance of Knowledge Flows

Although knowledge is understood as an essential driver of economic growth, it is hardly linked to growth in empirical analyses. The new growth theory proposed that knowledge stimulates technological progress, thereby increasing productivity. Romer (1986, 1990) and Lucas (1988) explained economic growth through the accumulation and spillover of technological knowledge. New knowledge is a crucial input factor for innovation and is commercialized by transforming it into new products, processes, and organizations. Research and development activities are a vehicle for private businesses, universities, and other research institutions to generate new knowledge. Firms face the decision to carry out research and development by themselves; engage in research alliances with other firms, universities, or government laborato-

ries; contract out specific research and development projects; and recruit researchers and scientists from other firms or research institutions (Bercovitz and Feldman, 2005; Arundel and Geuna, 2004). Therefore, not only the knowledge-producer but also other organizations such as private and public businesses, research institutions, or universities can also apply and commercialize the newly generated knowledge. Whereas the other organizations are usually in the same industry or discipline, they may also be in related or different industries or disciplines. However, the possibility to exploit knowledge from the environment particularly requires it to flow. Knowledge spillovers allow other economic actors to exploit the newly created knowledge as well as resulting in an acceleration of economic growth. Cohen and Levinthal (1989) conclude that research and development activities not only generate innovations but also increase the firm's ability to identify, assimilate, and exploit externally created knowledge (see also Cohen and Levinthal, 1990; Zucker et al., 1998). This indicates that the higher the level of research and development activities, the greater the level of absorptive capacity as well as the pool of knowledge that can be exploited.

The created knowledge may be underexploited. One explanation may be that incumbent firms do not want to take the risk combined with new products or processes. They might focus on exploiting the profit possibilities of their given product program, and they are not interested in searching for new opportunities and realizing them (Audretsch, 1995; Geroski, 1995). Furthermore, the deployed technology, the factual production capacity, or the availability of qualified human capital may also affect the exploitation of knowledge. Even if firms do not commercialize knowledge to the full extent, patenting or secrecy may be an effective tool in order to protect intellectual property and to hinder knowledge spillovers (Cohen et al., 2002a). Cohen (2005) suggests that patents are not as important as secrecy, lead time, and complementary capabilities which are the key mechanisms for appropriating returns to innovations in most industries. Patents only play a critical role in a small number of industries, in particular drugs and medical equipment; other industries use the other mechanisms to protect innovations (see also Arora et al., 2004). Underexploited knowledge also results if research carried out at universities and research institutions is hardly translated into new products or services (Pavitt, 2001). The primary two

missions of universities are research and teaching and not specifically the capitalization of their generated knowledge. A direct contribution to the industry via research alliances with firms as well as an active strategy in extending the research process into the development process are, possibly, a third mission of universities (Etzkowitz and Leydesdorff, 2000; Etzkowitz, 1998). Therefore, possible vehicles for the commercialization of academic research are university-industry partnerships or the creation of university spin-off companies (Rosenberg and Nelson, 1994; Hall et al., 2003; Arundel and Geuna, 2004; Meyer, 2003; Di Gregorio and Shane, 2003; Meyer-Krahmer and Schmoch, 1998). The importance of academic research was also underlined by Mansfield (1998) as well as by Beise and Stahl (1999). They concluded that a part of new products and processes could only be developed because of academic research and would have been substantially delayed otherwise.

Furthermore, different studies suggest that knowledge spillovers depend on a strong regional component, thereby taking advantage of spatial proximity to research facilities, universities, and industry specific agglomerations (Jaffe et al., 1993; Anselin et al., 1997, 2000; Audretsch and Feldman, 1996; Glaeser et al., 1992; Henderson et al., 1995). Analyzing patent citations, Jaffe et al. (1993) found that knowledge spillovers from academic research to private industries have a strong regional component. Arundel and Geuna (2004) found that proximity is important for the use of public science. Audretsch and Lehmann's (2005) study suggests that spillovers from university affect firm growth. The closer that firms are located to a university and the higher the number of academic papers published at this university, the higher the growth rates for these firms are. The argued explanation for the regional localization of knowledge is usually the tacit nature of knowledge, which is obtained via direct, interpersonal contacts (Anselin et al., 1997, 2000; Maskell and Malmberg, 1999; Hippel, 1987; Senker, 1995). As long as there is a delay between the discovery of knowledge and its codification, the premier mechanisms for knowledge flows are interpersonal interactions (Arundel and Geuna, 2004). Firms are then able to access knowledge faster and more successfully and are more likely to know where to access new knowledge via local, direct, and interpersonal contacts. A study by Meyer-Krahmer and Schmoch (1998) showed that informal contacts also have a high value for academic researchers. University researchers ranked collaborative

research and informal contacts as the two most important interaction types between universities and industry. According to in-depth interviews, both interaction types are characterized by a high degree of bi-directional exchange of knowledge.

Acs et al. (2005) develop the concept of a knowledge filter, which functions as a barrier limiting the total conversion of knowledge into new products, processes, and organizations. Thereby, knowledge is transformed into economically useful knowledge by either incumbent firms or start-ups. Incumbent firms learn, increase their absorptive capacity, and incorporate new knowledge into their firm-specific knowledge; thus, they absorb knowledge spillovers. New ventures are assumed to be the mechanism to transmit knowledge and transform it via knowledge spillovers into economically relevant knowledge. Nevertheless, their concept does not account for universities as knowledge-producers and university-industry relations as a mechanism for knowledge spillovers. I propose entrepreneurship as well as university-industry relations as possible transmission channels for knowledge and assume that they penetrate the knowledge filter, thereby stimulating the commercialization of knowledge. Furthermore, these two determinants in addition to research and development activities may, particularly, explain why regions post different growth rates.

Entrepreneurial activity, taking the opportunity and setting up a business, is one possible mechanism in which knowledge spills over and the capitalization of knowledge occurs. Founders of the new ventures might have worked for incumbent firms or universities before they commercialize the new knowledge, thereby inheriting knowledge from their former employer. Innovative start-ups may introduce new products or even create new markets. According to Audretsch (1995), many radical innovations have been introduced by new firms rather than by incumbents. Studies on spin-offs found that frustration with the (former) employer as well as the expectation of greater financial rewards are reasons that cause individuals to leave their employer and lead them to create their own firm (Garvin, 1983; Klepper and Sleeper, 2005). Starting a firm might be the most promising or even the only possibility to commercialize knowledge (Audretsch, 1995). Particularly, frustration may arise among the scientists and engineers if their ideas about a new product or process are rejected by their employer (see Garvin, 1983 for examples). According to Agarwal et al. (2004), existing organizations with abundant underexploited knowledge represent

seed-beds for spin-offs. Employee mobility and spin-offs are important vehicles for the diffusion of knowledge in technology- or knowledge-intensive industries. This pattern can be observed in the laser industry, disk drive industry, tire industry, and the wireless telecommunication industry (Klepper and Sleeper, 2005; Buenstorf and Klepper, 2005; Agarwal et al., 2004; Dahl et al., 2003; Sull, 2001; Franco and Filson, 2000; Christensen, 1993).

University-industry linkages are proposed as the second mechanism facilitating the exploitation of knowledge and the flow of ideas (Mansfield and Lee, 1996; Fritsch and Lukas, 2001; Arundel and Geuna, 2004; Meyer-Krahmer and Schmoch, 1998). Interactions between universities and industry are recognized to increase the rate of innovation in the economy and many governments have taken up the cause of enhancing these research alliances (Cohen et al., 2002a; Spencer, 2001; Laursen and Salter, 2004). According to the European Commission, firms in Europe especially fail to commercialize new knowledge generated in universities and other public research institutions in comparison to their U.S. counterparts (EC, 2001; Arundel and Geuna, 2004). Unsurprisingly, public research hardly results in ready-to-produce innovations; however, if the generated knowledge is transferred via research alliances it may accelerate technology transfer and enable firms to develop new products and processes (Cohen et al., 2002a; Spencer, 2001; Mansfield, 1991, 1998; Rosenberg and Nelson, 1994).

The types of university-industry relations amongst others may include informal information sharing among research partners, one-on-one research ventures, contract research on solving a specific problem of firms, or seminars for industry (Hertzfeld et al., 2005; Meyer-Krahmer and Schmoch, 1998). Arundel and Geuna (2004) found that Europe's largest firms mainly assess public research output by hiring trained scientists and engineers, through informal personal contacts, by contracting research out to public research organizations, and through joint research projects. Analyzing the influence of public research on industrial R&D in the U.S., Cohen et al. (2002b) found that the dominant channel of knowledge transfer was publications and reports followed by informal exchange, public meetings or conferences, and consulting. Businesses rated contract research, cooperative ventures, patens, and hiring graduates as moderately important. However, they only included those firms with R&D labo-

ratories in their study. Scott (2003) points out that firms use research alliances with universities as a vehicle to expand and complement their absorptive capacity. Especially firms that have downsized their research and development facilities may benefit from linkages with universities (Adams et al., 2001). Additionally, small ventures use collaborative research with universities or research institutions to obtain access to R&D inputs (Audretsch and Feldman, 1996). On the contrary, Czarnitzki and Rammer's (2000) study suggests that firms with fewer than 500 employees use less knowledge from universities and research institutions than large firms. In manufacturing, only 11 percent of the small firms draw knowledge from publicly funded research institutes compared to 24 percent of large firms. Moreover, universities are used more often as a source of knowledge than other research institutions such as Fraunhofer Gesellschaft or Max Planck Society. Laursen and Salter (2004) found that firms which frequently draw from externally generated knowledge are also more likely to use universities as a source of knowledge (see also Bercovitz and Feldman, 2005). Therefore, university-industry research partnerships are transmission channels for both small and large firms to generate, receive, apply, and commercialize knowledge.

4.3 Data and Methodology

In order to test the hypothesis that entrepreneurship and university-industry relations stimulate economic growth, a Cobb-Douglas production function is employed in order to estimate regional economic performance for the West German regions between 1992 and 2002 (in the style of Audretsch and Keilbach, 2004). The analysis is restricted to West Germany because East Germany can be regarded as a special case with very specific conditions not comparable to the West in the 1990s (Fritsch, 2004; Kronthaler, 2005). One important contribution of this chapter is the analysis of panel data, hence, the consideration of the cross-section and time-series dimension. The spatial analysis is on the level of planning regions, which usually consist of a core city and the surrounding counties. There are at least two reasons to use the spatial concept of planning regions. First, they account for the economic interaction between the counties and cities. Secondly, most universities in Germany are located in cities. The spatial concept of planning regions takes into account that adjacent districts

without a university benefit from research carried out at universities in the same planning region.[15]

The following model is employed to analyze the impact of capital, research and development, entrepreneurship, and university-industry relations on economic performance:

$$\ln\left(Y_{it}/L_{it}\right) = \alpha_1 \ln\left(K_{it}/L_{it}\right) + \alpha_2 \ln L_{it} + \alpha_3 \ln RDI_{it} + \alpha_4 \ln RDP_{it} + \alpha_5 \ln E_{it} + \alpha_6 \ln UI_{it} + \alpha_7 AGG_{it} + \varphi_{it} + \mu_i + \nu_{it}$$

The parameter α_1 represents the elasticity of capital intensity. An additional term on labor is included in the model to test for deviation from the case of constant returns to scale (parameter α_2), which proves to be significant. The output elasticities of R&D in private businesses (*RDI*) and in universities (*RDP*) are measured by the parameters α_3 and α_4. The impact of entrepreneurship (*E*) and university-industry relationships (*UI*) is measured by the parameters α_5 and α_6. The model includes population density (*AGG*) as a control variable. Population density is meant to control for agglomeration externalities, e.g., the proximity to universities and research institutions, availability of human capital and highly skilled employees. The subscript *i* denotes the planning regions in West Germany and *t* denotes time, namely 1992 to 2002. The fixed-effect estimator allows controlling for the unobservable regional specific effect (μ_i). The regressions estimate the heteroscedasticity-robust standard error. Additionally, the regressions control for spatial autocorrelation by including the average residuals of adjacent regions (φ_{it}).

Regional aggregate output *Y* is measured by regional gross value added of all industries (at constant 1995 prices). The physical capital stock *K* is estimated with gross fixed capital formation (investments, at constant 1995 prices) following the perpetual inventory method (see also Audretsch and Keilbach, 2004a or Audretsch et

15 Although polytechnics (also called universities of applied science or *Fachhochschule* in German) are located in smaller cities and rural areas, they receive very little in the way of grants from private businesses. Only one planning region does not have a university or a polytechnic. Grants from industrial sources do not exist in about ten percent of the planning regions. This is often due to the fact that music conservatories and art schools rarely receive research grants from private businesses. There are a few examples of universities that did not receive any grants, as well.

al., 2006).[16] Due to confidentiality, the gross fixed capital formation of some districts is not reported; therefore, two planning regions had to be excluded from the analysis. Labor L is measured by the number of employees. The establishment file of the German Social Insurance Statistics provided the number of employees in each region. The number of employees does not comprise civil servants, army personnel, or self-employed because they are not obliged to contribute to the social insurance system. Only employees in public and private businesses must be reported to the Federal Employment Office for enrollment in the social insurance system (for details see Fritsch and Brixy, 2004).

The share of employees devoted to research and development in the private sector measures R&D in private industries (*RDI*). Public research (*RDP*) is measured by the share of researchers and scientists at universities per overall employees in the respective region. Employees in the private sector who have a university degree in engineering or natural science are used as a proxy for employees engaged in research and development in private businesses. Information exists for the years from 1987 to 2002. It is most likely that the number of employees engaged in research and development is overestimated. First, not every employee in these occupations must be automatically engaged in research and development. Secondly, researchers may move from research and development into other functions later in their career, for example, the co-ordination of other researchers or staff (Zellner, 2003; Biddle and Roberts, 1993). The share of employees characterized as R&D personnel ranges from 0.8 percent to 5.7 percent. The Federal Statistical Office provided data on the number of researchers and scientists at each university for the years 1992-2002. Researchers and scientists are comprised of professors, research assistants, or technical personal in laboratories (all full-time personal). On average, 0.3 percent of the employees in each region are scientists or researchers at universities.

16 Various publications of the Federal Statistical Office and statistical offices of each state provided data on regional gross value added and gross fixed capital formation (investments). Data on gross fixed capital formation (investment) are annually published by each statistical office of the German Federal States (series E I 6). Data on regional gross value added are published by the working group of the Statistical Offices of the German Federal States, *Volkswirtschaftliche Gesamtrechnung der Laender* every other year between 1976 and 1990 and annually since 1992.

Regional entrepreneurial activity is measured by the number of new ventures formed per 1,000 employees in the respective district. The German Social Insurance Statistics (IAB) as well as the ZEW foundation panel provided information on regional entrepreneurship. Both data sources are not fully comparable but complement one another. First, the German Social Insurance Statistics only lists new businesses with at least one employee who is subject to obligatory social insurance (for details see Fritsch and Brixy, 2004). The ZEW Foundation Panel also registers start-ups consisting of only owners and only new independent firms not branches or plants of existing firms (for more detail see Almus et al., 2002; for details on a comparison see Fritsch and Niese, 2002). Between 1996 and 1998 the German Social Insurance Statistics reported on average 189,000 start-ups and the ZEW Foundation Panel reported 260,000 start-ups (Fritsch and Niese, 2002). The number of start-ups is correlated by 0.95 on the regional level between 1992 and 2002.

The advantage of the ZEW Foundation Panel is that it allows identifying innovative start-ups on the basis of the NACE industry classification (Nomenclature générale des Activités économique dans les Communautés Européennes) since 1990. The German Social Insurance Statistics first introduced the NACE as an industry classification in 1998, using another industry classification since 1983. The industry classification NACE allows identifying innovative start-ups: namely, start-ups in R&D-intensive manufacturing industries, knowledge-intensive services, and technology-intensive services. It is assumed that start-ups in innovative industries reflect knowledge-related entrepreneurship. Founders of businesses in innovative industries are rather unlikely to start a venture out of necessity and are more likely to enhance knowledge spillovers by being a spin-off of a research intensive firm or research institution. The share of innovative start-ups is used as an indicator of knowledge related entrepreneurship. According to the ZEW Foundation Panel, the share of innovative start-ups, start-ups in knowledge- and technology-intensive service industries, is on average 12 percent.

The regional level of university-industry relations is measured by the amount of grants given from firms in the private sector to universities per academic researchers and scientists (constant 1995 prices). This information is available for each university and has been aggregated to the spatial level of planning regions from 1992 to

2002. The available data on industry grants do not differentiate between disciplines such as mathematics, information technologies, biology, physics, chemistry, engineering, medicine, or social science. Only the total amount of grants (comprising of grants from the German Science Foundation, industry, governmental organizations, and foundations) is separately reported for different disciplines. Although the total value of grants from industrial sources is highly correlated with the total value of all grants with a correlation coefficient of 0.95, the distribution between the disciplines cannot be assumed to be the same. Some disciplines might be dominated by industrial funds, others by the foundations, or governmental institutions.

Table 4.1 Descriptive statistics

	Mean	Std. dev.	Minimum	Maximum
Share of employees in R&D in private industries to all employees (%)	2.26%	0.94	0.84%	5.69%
Share of researcher and scientists in universities to all employees (%)	0.26%	0.24	0%	1.15%
Start-up rate (German Insurance Statistics)	7.27	1.49	4.53	13.66
Grants from firms in private industries (thousand Euro, constant 1995 prices)	80,557	139,727	0	1,129,768
Total amount of grant (thousand Euro, constant 1995 prices)	26,421	36,199	0	260,486
Share grants from industry to total amount of grants	27.46%	21.70	0	100%
Share of total amount of grants by selected general disciplines:				
• Mathematics and information technologies	4.90%	8.22	0%	61.17%
• Natural sciences (biology, chemistry, physics)	16.38%	16.10	0%	78.81%
• Medicine	13.17%	19.70	0%	89.76%
• Engineering sciences	20.49%	26.22	0%	100.00%
• Social sciences (linguistics, cultural studies, economics and business, law etc.)	17.68%	21.12	0%	100.00%
Population density (inhabitants per square kilometer)	337.43	377.09	71.54	2288.01

Notes: All data on the regional level and within the time period of 1992-2002.

A closer examination of the total amount of grants regarding different disciplines shows that engineering receives most of the grants. The field of engineering acquired on average 20 percent of all grants. Researchers and scientists in natural science (i.e., biology, chemistry, or physics) acquired on average 16 percent of all grants. The disciplines of mathematics and information technologies received on average 5 percent of all grants and are, herewith, even behind general social sciences. Furthermore, the universities, unfortunately, are not asked to report the location of financial granter. Therefore, there is no information on the location of the firms that gave

grants. Of course, it is rather unlikely that research alliances are only formed between firms and universities that are located in the same planning region. However, Mansfield and Lee (1996) concluded that the proximity of a university in addition to its size and quality enhance research collaboration between large U.S. corporations and universities. Fritsch and Schwirten (1999) analyzed three German regions and found that research partners of universities and polytechnics are mostly located in Germany and about 40 percent are located in the close surroundings of the universities or polytechnics. Nevertheless, location may be less relevant if the university's research is unique and indispensable for a firm and such research can be purchased easily

4.4 Entrepreneurship and University-Industry Relations and Economic Growth

If entrepreneurship and university-industry relations are successful in penetrating the knowledge filter, knowledge flows are facilitated and a positive impact on economic performance can be expected. The empirical results indicate that not only physical capital and labor are sources of growth but also the regional knowledge stock, entrepreneurship, and university-industry relations are relevant. A statistically positive relationship between regional labor productivity and capital intensity is always found (table 4.2). The results confirm that both research in private firms and at universities are necessary conditions for economic growth (model I and II). The impact of research and development activities in the private sector on regional economic performance is stronger than the impact of research carried out at universities. A possible explanation for the lower impact of university research is that knowledge generated in universities is rarely commercialized by the university, it still needs to be applied, and does not automatically result in new products and processes (see also Pavitt, 2001). Its commercialization depends on additional knowledge transfer channels.

The two proposed transmission channels for knowledge spillovers enter the regression in the predicted positive way (model III). Regions with a higher level of new firm formation activity also experience greater economic productivity. Setting up a firm reflects the commercialization of knowledge. Entrepreneurship penetrates

the knowledge filter and stimulates economic growth. University-industry relations also confirm their ability to penetrate the knowledge filter.

Table 4.2 Impact of general entrepreneurship and university-industry relations on regional economic performance

	Economic performance	
	(I)	(II)
Capital intensity	0.113**	0.157**
	(2.96)	(4.35)
Labor	–0.546**	–0.402**
	(11.87)	(9.30)
R&D in private industries (RDI)	0.228**	0.178**
	(9.57)	(8.39)
R&D in universities (RDP)	0.034**	0.029*
	(5.58)	(4.91)
Entrepreneurship (start-up rate)	–	0.133**
		(15.45)
University-industry relations (industrial grants per researcher)	–	0.006**
		(3.86)
Agglomeration (population density)	0.001**	0.001**
	(3.08)	(3.27)
Spatial autocorrelation (error)	0.865**	0.809**
	(14.52)	(12.65)
Constant	4.962**	2.566**
	(7.15)	(3.89)
R^2-adjusted	0.7258	0.7602
F-Value	352.86	321.13
Observations	767	767

Notes: ** significant at 1%-level, * significant at 5%-level, t-values in parentheses, fixed-effect estimator with heteroscedasticity robust standard errors.

The results suggest that research relations are a significant vehicle to commercialize the knowledge generated at universities, which is usually abundant but underexploited. Research collaboration between the industrial sector and universities allow knowledge transfers in both directions and significantly affect regional economic productivity. The region's population density controls for agglomeration externalities, which proves to be positive and significant. Agglomerated areas are usually characterized by a greater amount of skilled labor, human capital, and research institutions which are conducive to superior economic performance (Glaeser et al., 1992).

The general measure of entrepreneurship may be misleading because it does not differentiate between necessity and opportunity entrepreneurship. New ventures in knowledge- or technology-intensive industries are most likely founded because of

opportunities and are a better reflection of knowledge spillovers. Therefore, the proportion of innovative start-ups (based on the ZEW Foundation Panel) is included in the model to measure knowledge-related entrepreneurship (table 4.3). Knowledge-related entrepreneurship can be interpreted as a premium additional to the rate of return of general entrepreneurship. New firms in innovative industries are an important mechanism for knowledge spillovers and the commercialization of knowledge.

Table 4.3 Impact of knowledge-related entrepreneurship and university-industry relations on regional economic performance

	Economic performance		
	(I)	(II)	(III)
Capital intensity	0.149**	0.148**	0.156**
	(4.19)	(4.29)	(4.88)
Labor	-0.412**	-0.419**	-0.412**
	(9.48)	(9.94)	(10.17)
R&D in private industries (RDI)	0.177**	0.176**	0.172**
	(8.47)	(8.40)	(8.51)
R&D in universities (RDP)	0.028**	0.029**	0.026**
	(4.75)	(4.61)	(4.80)
Entrepreneurship (start-up rate)	0.123**	0.125**	0.121**
	(13.76)	(14.04)	(13.83)
Share innovative start-ups	0.211**	0.208**	0.177**
	(2.85)	(2.79)	(2.41)
University-industry relations (industrial grants per researcher)	0.006**		
	(3.80)		
Grants total amount per researcher	–	0.008**	
		(2.95)	
Grants engineering sciences per researcher	–		0.015**
			(3.83)
Grants mathematics and information technologies per researcher	–		0.026**
			(2.67)
Grants natural science per researcher	–		-0.006
			(1.31)
Agglomeration (population density)	0.001**	0.001**	0.001**
	(2.94)	(2.89)	(3.10)
Spatial autocorrelation (residuals)	0.795**	0.787**	0.776**
	(12.44)	(12.97)	(12.83)
Constant	2.734**	2.816**	2.665**
	(4.13)	(4.41)	(4.42)
R^2-adjusted	0.7620	0.7613	0.7684
F-Value	281.42	287.30	249.54
Observations	767	767	767

Notes: ** significant at 1%-level, * significant at 5%-level, t-values in parentheses, fixed-effect estimator with heteroscedasticity robust standard errors.

Furthermore, results suggest that regional divergence is amplified if regions with a low level of innovative start-ups are not able to close the gap with other regions. Audretsch and Keilbach (2004b) found that high-tech and knowledge-intensive en-

trepreneurship had a positive impact on the region's growth rate of labor productivity.

The effect of university-industry relations most likely differs by discipline, i.e., engineering, natural science, information technologies. Some disciplines like social science receive few grants from industrial sources but do receive grants from the German Science Foundation or other governmental institutions. As mentioned earlier, statistics regarding industrial grants do not allow a differentiation between disciplines. However, since the total value of grants from industry, German Science Foundation, or other governmental agencies is reported separately and the total value is highly correlated with industrial grants, the total value of grants per researcher in each discipline is used as a proxy (compare model I and II, table 4.3). Grants in engineering sciences significantly affect regional economic performance. Grants in mathematics and information technologies are also significant. Research in natural science is less applied, and the results show that grants in this area do not have a direct effect on regional economic performance. The results are not surprising; research in engineering sciences is expected to be more applied in nature.

4.5 Concluding Remarks

This chapter addresses an important research question – the transfer and commercialization of knowledge through entrepreneurship as well as university-industry relationships and the impact of this on regional economic growth. The results are threefold. First, a well developed regional knowledge stock is a crucial determinant of regional economic performance. New knowledge needs to be generated at existing firms and research institutions before it can be exploited. Researchers at firms and universities must be able to apply and assimilate knowledge. The evidence suggests that both basic and applied research promote growth. Secondly, regions with a higher level of entrepreneurship experience greater economic performance. In particular, new firm formation in innovative industries is an important mechanism to commercialize knowledge. Thirdly, universities are a source of innovations: the more firms draw from knowledge generated at universities, the more those regions experience economic growth. Consequently, I conclude that the proposed knowledge transmis-

sion channels – entrepreneurship and university-industry relations – increase the permeability of the knowledge filter, thus improving regional economic performance.

Empirical studies found that firms are most likely to draw from university research if they follow specific innovation strategies. Firms with internal R&D strategies that focus on exploratory activities will allocate a greater share of their R&D resources to grants supporting university research. Furthermore, firms specifically prefer universities as research partners when they are concerned about the appropriation of the results (see also Schmidt, 2005). Laursen and Salter (2004) found that firms using university knowledge are in a small number of industrial sectors and that these firms already have a more open-search strategy drawing from external knowledge sources. Additionally, universities are of modest importance compared to other knowledge resources such as suppliers and customers. Therefore, research visibility of universities is important and should be increased if possible. The German government and the European Commission have already introduced various instruments to foster research partnerships and cooperation between universities, research institutes, and private businesses. Public support programs are usually conditional on being joint research projects between different actors, e.g,. private businesses, universities, or other research institutions.

Policy implications regarding entrepreneurship would be to stimulate entrepreneurial awareness and to develop entrepreneurial skills. It is not sufficient to have policies based solely on the generation of knowledge but rather policies need to be based on the exploration and commercialization of new knowledge. Furthermore, especially innovative start-ups may encounter financial constraints. Thus, public policy may focus on creating a healthy business environment for venture capitalists.

5 Exploiting Entrepreneurial Opportunities: The Impact of Entrepreneurship on Growth*

5.1 Introduction

Entrepreneurial opportunities exist and individuals just need to recognize them. If they have the willpower and decide to exploit an existing opportunity, this will lead to economic growth. Stop – is it really that easy? There are at least two arguments which indicate that the relationship between opportunities, entrepreneurship, and economic growth is more complicated. Firstly, opportunities do not fall from heaven like manna – they need to be created. Secondly, an individual needs to make the decision about whether or not to exploit the opportunity. Demographic and psychological characteristics are a powerful influence on the individual's decision (see chapter 6 for an overview of the literature). The process of generating opportunities involves individuals, firms, universities, and research institutions. Their research and development activities not only create new knowledge, they are also the precondition for the ability to identify, absorb, and exploit knowledge. This knowledge may have also been generated by other actors in the same or different industry (Cohen and Levinthal, 1989). Entrepreneurial opportunities particularly arise if existing organizations do not capitalize knowledge to the full extent. Firms with abundant underexploited knowledge are a breeding ground for entrepreneurial opportunities, which may cause spin-offs (Agarwal et al., 2004; Franco and Filson, 2000).

This chapter analyzes the relationship between the exploitation of entrepreneurial opportunities and regional economic growth. In particular, this chapter explores if those regions that increased their new firm formation activity also experienced higher economic growth rates. The previous chapter indicated that regions with a higher start-up rate also have higher economic performance measured as labor productivity. Assuming that entrepreneurship challenges and displaces less innovative incumbents,

* This chapter has greatly benefited from comments and suggestions made by David Audretsch, Zoltan Acs, Vera Troeger, Mark Sanders, Guido Buenstorf, and Michael Fritsch.

entrepreneurship leads to a higher degree of economic growth (see Schumpeter, 1911; Baumol et al. 1988; Fritsch and Mueller, 2004; Audretsch et al., 2006).

New ventures are suggested to be a mechanism for knowledge diffusion and knowledge exploitation (see also Acs et al., 2005). New firms, founded to capitalize abundant underexploited knowledge, may also amplify innovation by introducing new products and processes to the market (Audretsch, 1995). Certainly, regional economic growth is only partly stimulated by entrepreneurship but mainly determined by research and development activities in existing firms, investments in physical capital stocks, and human capital. Knowledge generated through R&D activities of existing firms represent the knowledge stock for this particular region. Consequently, regions with less research and development activities are characterized by a lower level of absorptive capacity and are expected to experience lower growth rates.

This chapter is organized as follows. Section 5.2 presents the theoretical framework and links the exploitation of entrepreneurial opportunities to economic growth. The methodology and database is described in section 5.3. It is empirically tested if the development of start-ups is a mechanism to facilitate knowledge spillover and thus stimulate growth in economic output (section 5.4). Section 5.5 provides a summary and a conclusion.

5.2 Knowledge, Entrepreneurial Opportunities and Their Impact on Economic Growth

With the new growth theory, knowledge is recognized as an essential driver of economic growth. However, it is rarely linked to economic growth in empirical analyses. Knowledge may increase productivity by stimulating technological progress. Romer (1986, 1990) and Lucas (1988) explained economic growth through the accumulation and spillover of technological knowledge. New knowledge may lead to innovations and is capitalized by transforming it into new products, processes, and organizations. Private businesses, universities, and other research institutions generate new knowledge through research and development. The created knowledge may be exploited by the knowledge-producer or by other organizations; therefore, knowledge flows are crucial. These other organizations may be other existing firms in the same industry,

related or different industries or disciplines, or individuals who decide to leave their current employer to start their own venture.

Cohen and Levinthal (1989) argue that research and development activities not only generate innovations but also increase the firm's ability to identify, assimilate, and exploit externally created knowledge (see also Cohen and Levinthal, 1990; Zucker et al., 1998) for more details on absorptive capacity). Applied on the regional level, this would indicate that the higher the level of research and development activities in a region is, the more the region's absorptive capacity will be developed. Various empirical analyses have shown that knowledge spillovers are spatially bounded (Jaffe et al., 1993; Anselin et al., 1997, 2000; Audretsch and Feldman, 1996)[17]. Knowledge depends on a strong regional component, taking advantage of spatial proximity to research facilities, universities, and industry specific agglomerations. Analyzing patent citations, Jaffe et al. (1993) found that knowledge spillovers from academic research to private industries have a strong regional component (see also Arundel and Geuna, 2004, for the importance of proximity for the use of public science). The argued explanation for the regional localization of knowledge is usually the tacit nature of knowledge which requires direct, inter-personal contacts to be obtained (Anselin et al., 1997, 2000; Maskell and Malmberg, 1999; Hippel, 1987; Senker, 1995). Arundel and Geuna (2004) propose that as long as there is a delay between the discovery of knowledge and its codification, inter-personal interactions are premier mechanisms for knowledge flows. Hence, proximity may be relevant because local, direct, and inter-personal contacts enable businesses to access knowledge faster and more successfully and firms are more likely to know the source of new knowledge where they can draw from (see Gorman, 2002 for an overview of the different types of knowledge).

Knowledge may be underexploited to a large extent. First, incumbent firms do not want to take the risk combined with new products or processes. Secondly, they do not value the emerged new opportunities to be profitable. Incumbents could be more interested in exploiting the profit possibilities of their given product program than realizing new opportunities (Audretsch, 1995; Geroski, 1995). Internal con-

17 See also Audretsch and Lehmann (2005), Audretsch et al. (2004).

straints (e.g., financial resources) might also hinder the commercialization of knowledge in these firms. Another reason might be that the research at universities and research institutions, in particular, is hardly translated into new products or services (Pavitt, 2001). Consequently, abundant knowledge exists, which may spur economic growth if it is also commercialized. In order to exploit it, firms or individuals must be able to recognize the underexploited knowledge, which requires absorptive capacity. Moreover, channels for knowledge spillovers need to exist, and the creation of new firms could be such a channel.

Starting a firm in order to realize an entrepreneurial opportunity is assumed as a mechanism for knowledge diffusion and for the exploitation of knowledge. If the founders of new ventures worked for incumbent firms or universities before commercializing their new knowledge, they inherit knowledge from their former employer. Studies on spin-offs have found that the reasons that cause individuals to leave their employer and to create their own firm are mainly frustration with their current employer and the expectation of greater financial rewards (see Garvin, 1983; also Klepper and Sleeper, 2005; Agarwal et al., 2004 for an overview). Particularly, frustration may arise among the scientists and engineers if their ideas about a new product or process are rejected by their supervisors or top management (see Garvin, 1983 for examples). Agarwal et al. (2004) found that, in particular, incumbent firms with abundant underexploited knowledge represent seed beds for spin-offs. According to Audretsch (1995), many radical innovations have been introduced by new firms rather than by incumbents. Especially in high-tech industries, employee mobility and spin-offs are an important mechanism for knowledge diffusion. In these industries, a high share of the new ventures is started by employees from incumbent firms by using some of the technological know-how of their former employer. Franco and Filson (2000) propose that existing firms characterized by technological know-how and continuous innovation provide a training ground for future entrepreneurs.

Regarding the relationship between entrepreneurship and economic growth, it can be expected that new firms in knowledge or technology-intensive industries are more relevant for economic growth. These firms tend to be more innovative and to be of higher quality than other entrants, and these characteristics may, in particular,

facilitate growth. The effects of new firm formation, as discussed in chapter 3, are expected to be more pronounced. Innovative start-ups may greatly challenge incumbent firms, thereby, securing their efficiency and enhancing structural change. Due to their innovativeness, these start-ups are most likely to amplify innovation and increase product variety. Christensen (1993) analyzed entry in the U.S. disk drive industry between 1976 and 1989; he found that spin-offs were more successful in surviving and that they generated more revenues than the non-spin-off entrants. A recent analysis of the disk drive industry supports the findings of Christensen; Agarwal et al. (2004) use data from the disk drive industry between 1977 and 1997 and can show that the probability of survival is higher for spin-offs than other entrants and that higher technological know-how also positively affects the survival chance.

5.3 Data and Methodology

The purpose of the chapter is to develop a regional model of economic growth for the West German regions between 1990 and 2002 and empirically test the hypothesis if an increase in entrepreneurship fosters economic growth. The analysis is restricted to West Germany because East Germany can be regarded as a special case with very specific conditions not comparable to the West in the 1990s (Fritsch, 2004; Kronthaler, 2005). The analysis focuses on the 1990s because data on innovative start-ups were not available for the 1980s. Since this analysis focuses on the increase of the output and input variables compared to the initial condition in 1990, the estimations account for a change between t and 1990. The spatial framework is on the level of planning regions. The advantage of planning regions is that these regions are functional units that consist of at least one core city and the surrounding area. Furthermore, planning regions account for economic interaction and the fact that core cities are usually strongly interwoven with their surrounding area. Therefore, the degree of spatial autocorrelation can be assumed to be rather low; lower than between districts.

The following model is employed to analyze the impact of changes in capital, labor, R&D activities, and entrepreneurship on economic growth:

$$\begin{aligned}\ln Y_{it} - \ln Y_{i1990} = \quad & \alpha_1(\ln K_{it} - \ln K_{i1990}) + \alpha_2(\ln L_{it} - \ln L_{i1990}) \\ & + \alpha_3(\ln KNOWI_{it} - \ln KONWI_{i1990}) \\ & + \alpha_4(\ln KNOWP_{it} - \ln KNOWP_{i1990}) \\ & + \alpha_5(\ln E_{it} - \ln E_{i1990}) + \varphi_{it} + \nu_{i,t}\end{aligned}$$

The parameter α_1 and α_2 measure the impact of a change in physical capital (*K*) and labor (*L*). The effect of an increase in R&D activities in private (*KNOWI*) and public (*KNOWP*) organizations is measured by the parameters α_3 and α_4. R&D activities in the private and public sector are meant to characterize the regional knowledge stock and, therefore, the absorptive capacity of a region. Regions that increased their knowledge stock are expected to experience stronger economic growth. The parameter α_5 measures the impact of an increase in entrepreneurial activity (*E*) on economic growth. It is assumed that the knowledge stock of adjacent regions also affects the regions economic performance. Therefore, a change in number of R&D employees in adjacent regions is included in order to control for regional spillovers (φ_{it}). The subscript *i* denotes the region and *t* the time period from 1990 until 2002.

Regional gross value added of all industries measures the regional aggregate output *Y* (at constant 1995 prices). The physical capital stock *K* is calculated from gross fixed capital formation (investments, at constant 1995 prices) following the perpetual inventory method (see also Audretsch and Keilbach, 2004a, b). All data on regional gross value added and gross fixed capital formation (investments) are from various publications of the Federal Statistical Office and statistical offices of each state (*Bundeslaender*).[18] Two planning regions had to be excluded from the data set because gross fixed capital formation was not reported due to confidentiality.

The number of employees in private and public organizations measures labor *L*, however, R&D employees are not included since they are measured with *KNOWI* and *KNOWP*. The number of employees in each region is from the establishment file of the German Social Insurance Statistics. In Germany all public and private employ-

18 Data on gross fixed capital formation (investment) are annually published by each Statistical Office of the German Federal States (series E I 6). Data on regional gross value added are published by the working group of the Statistical Offices of the German Federal States, *Volkswirtschaftliche Gesamtrechnung der Laender* biennially between 1976 and 1990 and annually since 1992.

ees must be reported to the Federal Employment Office for enrollment in the social insurance system. However, civil servants, army personnel, and self-employed are not obliged to contribute to the social insurance system and are, therefore, not included (for details see Fritsch and Brixy, 2004).

The regional knowledge stock, hence the region's absorptive capacity, is measured by R&D activities in private businesses (*KNOWI*) and organizations of the public sector (*KNOWP*) (e.g., research institutions, universities, and other public organizations). Since research and development is carried out by individuals and has a strong tacit dimension, the number of employees devoted to research and development is used as an approximation. The German Social Insurance Statistics provided the data, which were obtained from the employment statistics and are comprised of information on education and occupation of the listed employees. Employees are counted as R&D employees if they have at a university degree in natural science or engineering.

Regional entrepreneurship activity is measured by new firm creation in each region. The number of new firms was provided by the Centre for European Economic Research (ZEW) and was taken from their ZEW Firm Foundation Panel. The foundation panel is based on data provided biannually by Creditreform, the largest German credit-rating agency (for more details, see Almus et al., 2002). The data contain virtually all entries in the German Trade Register. Especially firms with large credit requirements such as high-technology firms are completely recorded. In 2002 about 180,000 entries were listed in Creditreform's database for West Germany. The information is available on the regional level and for a relatively long time period, between 1990 and 2003. The ZEW also provided the aggregated number of innovative start-ups for each region, which includes start-ups in knowledge- and technology-intensive industries. Therefore, the empirical analysis specifically differentiates between the impact of start-ups in innovative and the remaining industries. It is assumed that entrepreneurship in knowledge or technology-intensive industries has a stronger impact on economic growth because these start-ups are expected to be of higher quality and higher survival chances. Thus, the greatly challenge incumbent firms.

5.4 Entrepreneurial Opportunities and Economic Growth

The region's knowledge stock and entrepreneurial activity are expected to have a strong impact on regional economic growth: regions benefit from research and development activities and from individuals who exploit new knowledge by realizing entrepreneurial opportunities. The results indicate that regions which increased their knowledge stock through R&D activities in private and public industries compared to their initial conditions in 1990 and which increased their new firm formation activity compared to 1990 also realize stronger economic growth (table 5.1).

Table 5.1 Impact of entrepreneurship on regional economic growth

	Regional economic growth		
	(I)	(II)	(III)
Capital	0.111** (3.76)	0.110** (3.74)	0.111** (3.77)
Labor (without R&D employees)	0.277** (6.10)	0.308** (6.51)	0.310** (6.56)
KNOWI (R&D employees in private industries)	0.243** (11.88)	0.232** (11.14)	0.227** (10.83)
KNOWP (R&D employees in public organizations)	0.008* (1.97)	0.007 (1.72)	0.006 (2.38)
Entrepreneurship (all private industries)	—	0.025* (2.28)	—
Entrepreneurship (private industries, except knowledge- and technology-intensive)	—	—	0.004 (0.28)
Entrepreneurship (technology- and knowledge-intensive industries)	—	—	0.020* (2.38)
Knowledge stock adjacent regions (possible spillovers from adjacent regions)	0.338** (14.71)	0.338** (14.76)	0.331** (14.29)
Constant	–0.045** (4.09)	0.141** (12.70)	0.015 (1.39)
R^2-adjusted	0.8380	0.8388	0.8393
F-Value	64.54	64.09	63.55
Observations	959	959	959

Notes: ** significant at 1%-level, * significant at 5%-level, t-values in parentheses, regressions include regional dummies, which are here not reported.

It is very apparent that knowledge generated by private businesses has a much higher impact than knowledge from public organizations. The coefficient for the development of public R&D is lower and less significant. Reasons for the lower effect of knowledge created in public organizations could be that this knowledge, especially if it is created in universities or research institutions, hardly results in ready-to-produce innovations and is rarely translated into new products or services in the short run (Pavitt, 2001). A capitalization of the public knowledge stock is facilitated by

different mechanisms such as private firms hiring researchers or graduates, research partnerships with private firms, or spin-offs from universities. The results indicate that an increase in the region's knowledge stock generated by R&D carried out in private businesses is the fundamental determinant of economic growth. Therefore, regions were able to perpetuate and increase economic growth if they developed a strong regional knowledge stock.

Entrepreneurship proves to be an important vehicle for exploiting opportunities and stimulating growth: an increase in new firm formation activity stimulates economic growth. The results support Audretsch and Keilbach (2004a, b) and Acs et al. (2005) who also find a positive relationship between entrepreneurship and economic growth (see also chapter 4). Nevertheless, it is crucial to raise innovative start-up activity, which is more important than an increase in general start-up activity. A distinction between technology- and knowledge-intensive industries and the remaining industries demonstrates that the positive impact is based upon an enhancement of new innovative ventures. Innovative start-ups represent a greater challenge for incumbent firms and enhance the efficiency of incumbents which may lead to greater economic growth. While chapter 4 showed that innovative new firms are a premium on top of general entrepreneurship, these results indicate that it is crucial to increase start-up activity in innovative industries to realize stronger growth rates of gross value added. The results also show that an increase in the knowledge stock in adjacent regions also affects economic growth.

5.5 Discussion and Possible Policy Implications

The findings of the empirical analyses suggest that a strongly developed regional knowledge stock is a crucial determinant of economic growth. Particularly, research and development activities in the private sector are a fundamental element of growth. R&D in the public sector also affects economic growth but the magnitude is smaller. The differences in the magnitude of the effects are not surprising. New knowledge in private firms is more likely to be translated into new products or services and more likely without delay than knowledge, which is generated in universities or research institutions. Nevertheless, research in public organizations is often characterized by fundamental research and very important for the regional or national knowledge

stock. Transmission channels for this kind of knowledge could result in joint research projects or the transition of researchers into the private sector (see Arundel and Geuna, 2004 for different vehicles for private firms to assess public research). A high level of research and development is also more likely to guarantee that individuals or firms have the ability to apply and assimilate newly generated internal or external knowledge. Regions with strength in research and development activities may expect higher growth.

According to the empirical results, new firms are a vehicle to transfer and capitalize knowledge. The exploitation of entrepreneurial opportunities has a positive impact on economic growth. However, an increase in innovative start-up activity is more effective than an increase in general entrepreneurship. New firms in high-tech industries may reflect a higher quality and a higher probability of survival; therefore, these firms are more likely to contest market positions of incumbent firms and amplify innovations which lead to growth. Furthermore, a major number of entries in knowledge-intensive or technology-intensive industries could be the result of spin-offs from existing firms, an example of employee mobility and knowledge diffusion. Especially, firms with an abundant amount of underexploited knowledge act as seedbed for spin-offs (Agarwal et al., 2004) and are a playground for new founders (Franco and Filson, 2000).

Governments should not be misled in believing that more entrepreneurship will ultimately lead to higher economic growth. Entrepreneurship promotion policy may, however, start by stimulating entrepreneurial awareness and developing entrepreneurial skills. Founders with few assets and low quality start-ups have high failure rates and will suffer the most if they end up failing. Public policy should not focus on confidence and optimism of future entrepreneurs but rather on the quality of new firms and firms in high-tech industries. These start-ups, particularly, struggle with an imperfect financial market and are subject to financial constraints. Starting points could be, for instance, the establishment of a well-functioning venture capital market since loan capital is not their major source of financing.

6 Entrepreneurship in the Region: Breeding Ground for Nascent Entrepreneurs?*

6.1 Introduction: The Entrepreneurial Decision and the Social Environment

New firm formation is recognized to have an important stimulating effect on economic development (Audretsch et al., 2006; Reynolds et al., 2004a; Audretsch and Keilbach, 2004a, b; Fritsch and Mueller, 2004; van Stel and Storey, 2004). Nevertheless, it is rather unclear why entrepreneurship does not flourish evenly across regions and is greatly path-dependent. Due to the fact that nascent entrepreneurs are the potential founders of new ventures, it is crucial to understand why some individuals attempt to take the opportunity to become an entrepreneur while others neglect this opportunity. Furthermore, it is worth knowing to what extent the social environment and embeddedness influences an individual's decision to become an entrepreneur. The decision to start a new venture may be influenced by experience and prior knowledge (Shane, 2000; Wagner, 2004; Shepherd and DeTienne, 2005), social networks and contact to other entrepreneurs (Minniti, 2004, 2005; Davidsson and Honig, 2003; Singh et al., 1999); availability of financial capital or individual wealth (Evans and Jovanovich, 1989; Dunn and Holtz-Eakin, 2000; Kim et al., 2007), as well as expected profit and success.

A great number of empirical studies focus on the characteristics of nascent entrepreneurs analyzing why some individuals plan to become entrepreneurs and others do not (e.g. Parker, 2004; Davidsson, 2005; Wagner, 2004, 2005; Kim et al., 2007). From an economic perspective, an individual will only choose to become self-employed if the expected life-time utility from self-employment is greater than the life-time utility from paid-employment. Certainly, the expected life-time utility is based upon monetary and non-monetary returns whereas the non-monetary aspect is

* This chapter is based on Mueller (2005) and Mueller (2007). This chapter has greatly benefited from comments and suggestions made by Joachim Wagner, Simon Parker, David Storey, Michael Fritsch and Michael Niese.

found to be rather important (Moskowitz and Vissing-Jørgensen, 2002; Hamilton, 2000; Parker, 2004). Two recent studies by Wagner (2004, 2005) clearly indicate that role models are a crucial determinant for nascent entrepreneurs. Role models may be found in the family or in the work place: the existence of self-employed family members and work experience in small and young firms increases one's propensity to start a business (see also Dunn and Holtz-Eakin, 2000; Davidsson and Honig, 2003).

Parker (2004: 100) suggests that regions with strong entrepreneurial traditions have an advantage if they are able to perpetuate it over time and across generations. Minniti (2005) concludes that entrepreneurship is self-reinforcing in nature. According to chapter 2, the distinct regional differences in new business formation rates can be principally explained by previous entrepreneurial activity (see also Mueller et al., 2007). While the role of small and young firms as fertile ground for new venture creation has been analyzed in several studies on the regional level (chapter 2; Audretsch and Fritsch, 1994b; Gerlach and Wagner, 1994; Beesley and Hamilton, 1984), the question whether a high population of small and young firms, assumed as entrepreneurial firms, in a region influences the individual propensity to transit to self-employment is unexplored.

This chapter studies possible factors influencing the decision to become a nascent entrepreneur. This chapter complements recent work by combining regional and individual characteristics and analyzes if individuals follow social cues and are influenced by what others have chosen. In particular, the proposition is empirically tested that the presence of entrepreneurs in the social environment influences the decision to enter self-employment. The remainder of the chapter is structured as follows. Section 6.2 reviews the literature and develops hypotheses regarding the influence of the social environment on the individual decision on entrepreneurship. In section 6.3, previous research on human, social, and financial capital as a determinant of nascent entrepreneurship is reviewed and hypotheses are generated. Section 6.4 describes the data samples and provides descriptive statistics. Empirical results are presented and discussed in section 6.5, while section 6.6 provides conclusions.

6.2 The Local Entrepreneurial Environment and Nascent Entrepreneurship

Entrepreneurial activity not only tends to cluster geographically, it is also characterized by persistent regional differences over time. Silicon Valley, Boston's Route 128, or the Washington D.C.-region in the U.S., Stuttgart or Munich in Germany, and Bangalore in India are some of the well-known innovative industrial and entrepreneurial clusters. Generally, lower transaction costs due to the economics of scale and scope as well as the availability of qualified labor and proximity to customers, suppliers, and competitors are identified as possible causes of spatial concentration and the evolution of a cluster (Fujita and Thisse, 2002; Fujita et al., 1999; Feldman, 2001; Rocha and Sternberg, 2005; see also Minniti, 2005). Chapter 2 found strong evidence for regional persistency in entrepreneurial activity in West Germany; namely, more than 50 percent of the variance in entrepreneurial activity across regions is accounted for by entrepreneurial activity in the preceding year(s) (for similar results in British regions see Mueller et al. 2007). Therefore, the local social environment, particularly, the entrepreneurial environment must be taken into consideration in order to analyze and understand entrepreneurial decisions (Minniti, 2004, 2005; Aldrich and Fiol, 1994; Shapero, 1984; Granovetter, 1985; Dubini, 1989).

As Minniti (2005) argues, entrepreneurship is self-reinforcing by creating its own culture, thereby, encouraging individuals to engage in business formation. She develops a model of entrepreneurial dynamics analyzing the impact and importance of economic and social variables on entrepreneurial decisions. The individual faces uncertainty and ambiguity during the decision whether or not to become an entrepreneur. Uncertainty means that the potential entrepreneur may be uncertain about survival chances and has to deal with the possibility of failure. According to Minniti (2005) ambiguity means that information about the characteristics, needs, rewards, and problems of entrepreneurship are ambiguous, hence the individual is constrained to make decisions. Since individual decisions are most likely affected by social cues in ambiguous environments, individuals may be encouraged in exploiting an entrepreneurial opportunity the higher the presence of other entrepreneurs is (Aldrich, 2003; Minniti, 2005). The larger the number of entrepreneurs, the easier it is to ob-

serve and meet them. Thus individuals are able to gather information about necessary input factors, financial resources, potential suppliers, and customers as well as obtaining information about problems associated with the start-up process. Legitimacy may be another factor influencing whether and individual attempts to start a business or not. As soon as entrepreneurship is widely accepted running a business is seen as a profitable source of reward and entrepreneurs as well as the self-employed are perceived as role models, thereby, encouraging an entrepreneurial decision and sustaining an entrepreneurial culture (see also Aldrich and Fiol, 1994 for legitimacy in the context of an industry creation; Saxenian, 1998: 37). Owners of small and young firms may act as role models and stimuli because these firms are still evolving. It is expected that individuals follow social cues and are influenced by other entrepreneurs when facing the decision whether to start a firm or not. Accordingly, it is hypothesized that a greater presence of small and young firms encourages the individual's attempt to start a business.

6.3 Human, Social, and Financial Capital and Nascent Entrepreneurship

Human Capital and Nascent Entrepreneurship

Individuals with more experience and education are assumed to have a greater likelihood to enter self-employment. It is generally agreed that they are better informed about profitable opportunities, are more likely to possess the necessary skills, and rather have the financial resources required for starting a business (Davidsson and Honig, 2003; Kim et al., 2007; Wagner, 2004). Nevertheless, the relationship between education and the probability to step into self-employment is ambiguous; it has been found to be positive, negative, and insignificant (for an overview, see Parker, 2004: 73). One reason for this ambiguity might be that formal qualifications are not necessarily required for entrepreneurship (Parker, 2004: 73; Casson 2003: 208). While a post-secondary education may be fundamental for some knowledge or technology intensive industries, it could be less relevant for starting a business in the trades such as plumbing or carpentry. Kim et al. (2007) emphasize that although knowledge and skills gained in formal education are not necessarily relevant for starting a businesss, it may be a proxy for the social background, ambition, and endurance. The years of education seem to be a reasonable indicator for the acquired skills because it does not only account for a college education but also for vocational

training and apprenticeships, which are common in Germany. Accordingly, the years of education are expected to be positively correlated with the likelihood of being a nascent entrepreneur.

Work experience complements skills and knowledge acquired through education and enables employees to gain experience in fields necessary for running their own business. Employees with a managerial position are more likely to gain experience in establishing networks, hiring employees, and interacting with suppliers and customers. These skills may be particularly valuable in the gestation phase of a new business (Bates, 1995; Gimeno et al., 1997; Robinson and Sexton, 1994). While Kim et al. (2007) found that employees with managerial experience are more inclined to start a business, Davidsson and Honig (2003) could not confirm this. Managerial experience may be an especially worthwhile facet of human capital fostering routines that enable individuals to cope with challenges and problems and to recognize opportunities. Therefore, individuals with managerial experience are expected to have greater likelihoods of being a nascent entrepreneur than people without such experience.

Additionally, work experience gained in small and young firms enables employees to learn first-hand information about the start-up process, possible constraints as well as the problems and solutions during the start-up process by being in direct contact with the owner (Boden, 1996; Wagner, 2004). The owners of these young firms act as entrepreneurial role models, and, therefore, may enhance the probability of an employee to make the transition from wage-and-salary to self-employment. Wagner (2004) concluded that employees who work in small and young firms are more likely to become nascent entrepreneurs; he calls these firms hothouses for nascent entrepreneurship. Furthermore, employees in small firms have little opportunities for promotions once they are in a managerial position; therefore, maximizing their expected life-time utility will most likely involve a job change or starting their own venture. Accordingly, a positively correlated relationship between work experience in small firms and nascent entrepreneurship is expected. Additionally, it is hypothesized that especially the combination of both managerial work experience and work experience in small firms increases the propensity of an individual to become a nascent entrepreneur.

Individuals who were self-employed in the past are most likely to be predestined for another start-up activity. They have already gained experience and knowledge valuable for starting another venture. By analyzing differences between novice, portfolio, and serial founders, Westhead and Wright (1998) found that serial entrepreneurs were significantly more likely than novice founders to state that developing an idea for a product was a reason leading to start-up activity. Other reasons leading to start a business mainly were that they wanted to achieve something and to get recognition for it as well as that founding a firm made sense at that time in their life (see also Westhead et al., 2005). On the one hand individuals with entrepreneurial experience recognize possible mistakes and problems during the start-up phase; on the other hand they may be discouraged by negative experiences and causes of closure or failure (Westhead et al., 2005). Nevertheless, it is assumed that potential serial founders are well connected to other entrepreneurs and are more alert to existing and arising opportunities. Thus, previous entrepreneurial experience may be positively associated with the likelihood of being a nascent entrepreneur.

Social Capital and Nascent Entrepreneurship

It is generally acknowledged that social capital facilitates nascent entrepreneurship. Social capital helps individuals attempting to start a business obtain valuable resources needed in the gestation stage. Consistent with Davidsson and Honig (2003), social capital is understood as a concept of social exchange and social network in this chapter. Family members, friends, and colleagues provide both social networks as well as actual and potential resources. A number of studies investigated and confirmed the phenomenon that children of self-employed parents have a greater propensity to become entrepreneurs. Explanations for this intergenerational correlation might be that the parents can offer informal introduction to business methods, transfer valuable work experience, and provide access to capital and equipment, business networks, consultancy, and reputation (Parker, 2004: 85; Dunn and Holtz-Eakin, 2000; Blanchflower and Oswald, 1998; Aldrich et al., 1998). Additionally, growing up in a self-employed family may lead to a pro-business attitude, desire for independence, autonomy and wealth creation, and reduce the age at which they enter self-employment (Parker 2004: 85; Dunn and Holtz-Eakin, 2000). Analyzing data from the National Longitudinal Survey, Dunn and Holtz-Eakin (2000) found 30 percent of

sons of self-employed fathers and 20 percent of sons of self-employed mothers experienced some self-employment compared to twelve percent of sons without either parent self-employed. Lentz and Laband (1990) found that about every second self-employed individual had self-employed parents using a sample of self-employed proprietors from the National Federation of Independent Business in the U.S.

According to Dunn and Holtz-Eakin (2000) the strongest effect of parents on the transition to self-employment for sons does not run via financial channels but rather through the self-employment experience and business success of the parents. Surprisingly, Kim et al. (2007) did not find a significant positive impact of a parent as business owner on the likelihood of being a nascent entrepreneur. They offered different explanations for the missing evidence. First, information about the success of the parental business was missing. Second, parents were able to convince their children to abstain from the difficulties of starting and operating a business; or third, the relationship was limited to the stage of running a business and not planning a business. On the contrary, Davidsson and Honig (2003) found that having self-employed parents significantly increased the prospects of being a nascent entrepreneur (see also Renzulli et al., 2000; Aldrich et al., 1998; Davidsson, 2005; Matthews and Moser, 1995). Consequently, children of self-employed parents are more likely than others to be a nascent entrepreneur.

A spouse, partner, or close friend who is self-employed provides valuable social capital to nascent entrepreneurs as well. Employees attempting to start a business can benefit from their knowledge, entrepreneurial experience, and business networks which may results in easier access to capital and equipment. Furthermore, if they are satisfied with being self-employed they may encourage others to start their own business. Capital market constraints represent a barrier in financing the attempt to start a business; they may be eased by the personal wealth or financial resources of a household member who is self-employed. According to Davidsson and Honig (2003), individuals were twice as likely to be nascent entrepreneurs if they had close friends of neighbors in business. The impact may be assumed to be even higher if the spouse or partner is self-employed. Wagner (2005) and Wagner and Sternberg (2004) present similar results with individuals who have personal contact to an entrepreneur in the family; thus, they are more likely to be actively engaged in starting a business.

Therefore, individuals living together with a self-employed spouse or partner are expected to have higher likelihoods of being a nascent entrepreneur than people without this kind of social capital.

Financial Capital and Nascent Entrepreneurship

It is often argued that entrepreneurs face capital market constraints when trying to acquire financial resources necessary during the start-up process. A recent study by Levenson and Willard (2000) found that banks do not particularly ration credit to new enterprises; only two percent of entrepreneurs failed to obtain finance from banks. Their result supports an earlier study by Berger and Udell (1992); they assessed that U.S. commercial loans are not rationed. Therefore, credit rationing exclusively may not impede entry into self-employment but banks or lenders could provide less financial support the entrepreneur had requested. Parker and van Praag (2004) conclude from a study of Dutch start-up entrepreneurs that about 20 percent of them obtained less financial capital than requested.

Personal wealth may facilitate the transition to entrepreneurship because individuals possessing wealth – personal or family wealth – do not necessarily need to request money from banks and can self-finance the start-up process. Furthermore, they are able to bridge the gap when revenues or profits are not made during the gestation process. However, individuals with very high wealth levels probably choose other careers and might prefer to be angel investors and are less likely to start their business (see also Kim et al., 2007). In contrast, there are individuals who hardly possess personal wealth; for instance, they do not own a house, do not hold stocks or insurance policies, and some have few career options. Consequently, this group may have to choose self-employment out of necessity. Initial capital requirements depend on the type of business; some industries do not require a high level of start-up capital. Furthermore, not personal but rather household wealth may be relevant for entrepreneurship. A house, insurance policies, or other tangible assets are often possessed by more than one person, for instance a married couple. Therefore, a positive curvilinear relationship between household wealth and the likelihood of being a nascent entrepreneur is expected.

Personal or household income may be another determinant for individuals to attempt self-employment. Employees at higher income levels may find the opportunity costs too high to give up wage-employment due to uncertainty over potential income from business ownership. Kim et al. (2007) found that neither household wealth nor household income increased the likelihood of becoming a nascent entrepreneur. Hamilton (2000) as well as Moskowitz and Vissing-Jørgensen (2002) found that individuals achieved higher earnings from wage-and-salary than from self-employment in the U.S. This result is rather puzzling and raises questions as to why people become entrepreneurs. One possible explanation might the existence of large non-pecuniary benefits associated with self-employment.

Constant and Zimmermann (2006) found that native German employees earn less than their self-employed counterparts. The wage difference is even greater for immigrants; earnings from paid-employment are on average 40 percent lower than earnings from self-employment. The income differences are also found by the German Federal Statistical Office. The yearly net income of households, with a self-employed as principal wage earner, was on average 51,000 Euro in 2002. In contrast, households with a white-collar worker as the main earner received on average 23,700 Euro and households of blue collar workers on average 17,400 Euro. Consequently, starting a business may be a response to a higher potential income from self-employment. Especially for immigrants it might be a way to escape discrimination. Besides, the gestation process often takes place while the nascent entrepreneur is still employed; therefore, employees at lower income levels are less likely to be able to finance the start-up process. I propose either a positive or a positive curvilinear relationship between household income and the likelihood of being a nascent entrepreneur.

6.4 Data and Descriptive Statistics

Sample and data source

Data on nascent entrepreneurs are taken from the German Socio-Economic Panel Study (SOEP) conducted by the German Institute for Economic Research (DIW). The SOEP is a representative longitudinal panel study of private households in Germany which started in 1984 and is carried out annually. Households in East Germany

were included in the survey beginning in 1990. For this analysis, the survey from 2003 is used to identify nascent entrepreneurs. Nevertheless, relevant questions from earlier years are used as part of the panel dataset. There are different reasons to select only respondents from the 2003 survey. While most questions are asked annually, some questions are only asked in specific years or at specific time intervals. The main question which makes it possible to classify a respondent as a nascent entrepreneur was introduced in 1998, changed significantly in 1999, and has been asked biennially since then.[19] Other relevant questions, for instance, on risk behavior were asked in 2004 for the first time and questions on personal assets and liabilities in 2002. Another reason is the availability of the regional data for the entrepreneurial environment. In 1998, the new industry classification, NACE (Nomenclature générale des Activités économique dans les Communautés Européennes), was used for the first time. This came along with an abrupt increase in the number of new businesses. The reasons are rather unclear.[20] Furthermore, in order to identify small and young firms, for instance small firms that are at least three years old, entry cohorts were considered. In order to obtain reliable data on entry cohorts, data before 1999 is not considered. Therefore, the pool of small and young firms in 2003 consists of entries of the years 1999 to 2002.

The survey contains demographic characteristics such as gender, age, education, data on the respondent's employment status, work experience, and some basic characteristics of the current employer. Some data is on entrepreneurial activities; namely, the interviewees were asked if they are currently self-employed, or if they plan to become self-employed. The SOEP database has been used several times to analyze the issue of self-employment. For instance, the recent study by Constant and Zimmermann (2006) analyzed the characteristics of the self-employed immigrant and German males. Pfeiffer and Reize (2000) analyzed the transition from unemployment to self-employment.

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19 A cross-sectional time series analysis is rather problematic and might be misleading. Firstly, respondents are considered if they are paid-employees and not already self-employed. Since most respondents decide within the next two years if they transit to self-employment, employees in 2003 might be biased towards employees that did not consider or choose self-employment in 1999 and 2001. Thus, this group may represent employees who might never choose self-employment.

20 It is suspected that already existing branches of businesses were given their own industry code; therefore, they were counted as a new business.

In 2003, data were collected from 22,611 persons throughout Germany of which 18,118 persons are between the ages of 18 and 64. About 43 percent of the respondents were blue or white collar workers, less than 5 percent were civil servants. Almost 25 percent were retired and about 8 percent of the employable respondents (age 18–64) were unemployed. The analysis was restricted to those individuals who were employed and between 18 and 64 years old in 2003. Respondents who were civil servants, already self-employed, or out of the labor force (e.g. unemployed, retired, or full-time student) as well as respondents with relevant missing data were excluded from the dataset; thus, leaving 9,506 persons: 2,421 in the former East and 7,149 in the former West of Germany.

Nascent Entrepreneurs (dependent variable)

The Global Entrepreneurship Monitor (GEM) and the Panel Study of Entrepreneurial Dynamics (PSED) clearly classify individuals as nascent entrepreneurs if they are individually or with others actively involved in starting a new business that will at least partly belong to them. Additionally, they should not have paid full-time wages or salaries to anybody for more than three months (Reynolds et al. 2004a, 2004b). Particularly, these individuals are at a phase where they start looking for a location, organizing a start-up team, developing a business strategy, or searching for financial capital. They are not yet at a stage where they pay salaries or exchange products or services with customers; hence, they are still in the gestation stage of the start-up process. Furthermore, it is not definite if they will ever start their own firm. Empirical studies could show that up to 25 percent of the nascent entrepreneurs are no longer trying to set-up a firm the next year and between 30 and 50 percent operate their own business the next year (Parker, 2007; van Gelderen et al., 2001).

The German Socio-Economic Panel (SOEP) does not specifically ask if the respondent is actively engaged in the start-up process at the time of the interview, as it is asked in the GEM or PSED surveys. Therefore, the individuals were classified as nascent entrepreneur regarding to the following question: *How likely it is that the respondents will change their career and will become self-employed and/or freelance, and/or will become a self-employed professional within the next two years?* The individuals were asked to self-estimate the probability of such a change according to a scale from zero to 100 percent in increments of ten; with zero indicating that

such a change will definitely not take place and 100 meaning that such a change will definitely take place. On the one hand, about 77 percent of the employees definitely do not consider becoming self-employed within the next two years in the year 2003. On the other hand, one percent of the respondents are definitely certain that they will become self-employed. Certainly, it is implausible to assume that all interviewees who are somehow likely to become self-employed within the next 2 years should be considered nascent entrepreneurs. Employees estimating their probability to become self-employed to 10 or 20 percent are less likely to be already actively involved in starting a new business. Nevertheless, they might have taken it into consideration or might be less averse to it. These individuals might be characterized as latent entrepreneurs (Blanchflower et al., 2001).

The crucial and difficult question lies in separating the nascent entrepreneurs from the rest of the sample. The panel character of the SOEP allows a comparison of the self-reported intention with the actual outcome. The employees of the year 2003 are examined more closely. Unsurprisingly, those employees who self-estimated a higher propensity to enter self-employment were more likely to become self-employment the next year. About 15 percent of the 2003 employees with a reported probability of at least 90 percent became self-employed in 2004. If all respondents with a reported probability of at least 50 percent are considered as nascent entrepreneurs, the transition rate decreases to about 5 percent.[21] The comparison of the self-reported probabilities and the actual outcome indicates a distinctive break between the self-reported probability of 60 and 70 percent: about 8 percent of the 70 percent group became self-employed and only about 4 percent of the 60 percent group (table 6.1). These results are comparable to the nascent entrepreneurship rate found by the GEM survey and by the German Regional Entrepreneurship Monitor reporting a rate of about 3.5 percent for the years 2003 and 2004 (Sternberg and Lueckgen, 2005, Wagner 2004). Knowing that 36 percent of the newly self-employed in 2004, who were paid-employees in 2003, estimated that they would definitely not be self-employed within the next two years the threshold should probably not be set too high.

21 The basic pattern remains the same if respondents of the year 2001 are considered. 20 percent of the respondents, who reported a probability of at least 90 percent, became self-employed within the next two years. The transition rate decreases to five percent if only respondents with a self-reported intention of at least 50 percent are considered.

Table 6.1 Self-estimated probabilities and actual self-employment in the following years

	Employees in 2003			
Self-reported probability to become self-employed within next two years	Number (share) of individuals		Number (share) of individuals self-employed in 2004	
0 %	7,354	(77.36%)	35	(0.48%)
10 %	789	(8.30%)	5	(0.63%)
20 %	404	(4.25%)	4	(0.99%)
30 %	233	(2.45%)	4	(1.72%)
40 %	117	(1.23%)	3	(2.56%)
50 %	291	(3.06%)	13	(4.47%)
60 %	48	(0.50%)	2	(4.17%)
70 %	74	(0.78%)	6	(8.11%)
80 %	66	(0.69%)	4	(6.06%)
90 %	31	(0.33%)	5	(16.13%)
100 %	99	(1.04%)	15	(15.15%)
Total	9,506	(100.00%)	96	(1.01%)

Nevertheless, the examination also finds that respondents who rated their transition probability to be zero account for 36 percent of the actual self-employed in the following years. This result is puzzling since these individuals must have completely changed their mind from not considering self-employment as a career choice to actually being self-employed. Moreover, the self-reported intention towards self-employment is less likely to capture a general interest or desire in a job change. The respondents were also asked to estimate how likely it is that they, for instance, would look for a new job on their own initiative, lose their job, receive a promotion, be demoted at their current place of employment, or retire. Hence, self-employment is only one option amongst others and individuals who are unsatisfied with their current job or life in general do not automatically increase their intention to become self-employed.

The empirical analysis differentiates between two kinds of nascent entrepreneurs: employees who estimated their intention for at least 50 percent; and second employees who reported a probability for at least 70 percent. In the former case, the dependent variable is equal to one if the individual reports an intention of at least 50 percent and is equal to zero otherwise. In the second case, the dependent variable is equal to one if the individual reports an intention of at least 70 percent and is equal

to zero otherwise. The nascent entrepreneurship rates derived from the SOEP are not fully comparable to either the GEM rates or PSED rates, but the rates are rather complementary.

Entrepreneurial Environment

The individual data is linked with data which characterizes the regional entrepreneurial environment of each respondent. Information on small, young, and new businesses is from the establishment file of the German Social Insurance Statistics (as documented by Fritsch and Brixy, 2004). Since the database only reports businesses with at least one employee, start-ups consisting of only owners are not included. For this analysis, firms are defined as small and young firms if they are no more than three years old and had no more than 20 employees at the time the new venture was founded. The presence of newly founded ventures as well as the presence of small and young firms is measured by either start-ups or small and young firms per 1,000 population (inhabitants ages between 20 and 59) or by their share of all firms. The variables on the entrepreneurial environment report slightly higher values for the group of nascent entrepreneurs compared to employees. However, the mean values significantly differ only between nascent entrepreneurs with an intention of at least 50 percent and the comparison group of employees. The self-employment rate in a region could be considered as an indicator of entrepreneurial environment, as well. However, many self-employed are the owner of an older firm, and they are not confronted with problems arising during the start-up phase. Therefore, they may not be seen as role models for potential starters. Furthermore, the mean values of the self-employment rates do not differ significantly.

Human, social, and financial capital

The average nascent entrepreneur is fairly well-educated and the average years of education are 12.5 years (table 6.2). Interestingly, about 30 percent of the nascent entrepreneurs gained managerial experience. In this case, the employee is, for instance, the head of a department or a managing director. The interviewees were asked to classify the size of their current employer by the number of employees. Possible categories are less than 5, 5-19, 20-99, 100-199, and at least 200 employees. Unfortunately, the respondents do not specify the firm age, which would have al-

lowed for analyzing the impact of small and young firms. Consequently, only small firms could be identified. Nascent entrepreneurs are more often employed in small firms than the control group of employees. Thirty percent of nascent entrepreneurs worked in a firm with less than 20 employees compared to 25 percent of the employees. This relationship is inverted if work experience in firms with at least 200 employees is considered. Combining the two characteristics managerial functions and working in a small firm reveals that eight percent of nascent entrepreneurs meet both criteria.

Table 6.2 Descriptive statistics of nascent entrepreneurs

	Nascent entrepreneur, (intention at least 50 %)		Nascent entrepreneur, (intention at least 70 %)	
	Mean	Std. Dev.	Mean	Std. Dev.
Dependent variable:				
Nascent entrepreneurship rate	6.41%	0.24	2.84%	0.17
Independent variables:				
Entrepreneurial environment (social environment)				
Start-up rate	5.60*	0.87	5.54	0.85
New firms per 1,000 inhabitants	4.26***	0.62	4.22	0.61
Share of small and young firms	13.13**	1.91	13.00	1.86
Small and young firms per 1,000 inhabitants	10.01***	1.43	9.89	1.40
Human capital				
Years of education	12.62***	3.65	12.54***	3.40
Managerial experience (yes = 1)	30.21%***	0.46	30.00%***	0.46
Working in small firm <20 employees (yes = 1)	31.03%***	0.46	30.74%**	0.46
Working in medium size firm 20-199 employees (yes = 1)	26.93%	0.44	27.04%	0.45
Working in large firm ≥200 employees (yes = 1)	32.02%***	0.47	31.85%***	0.47
Small firm and managerial experience (yes = 1)	8.21%***	0.27	8.15%***	0.27
Previous self-employment experience (yes = 1)	2.96%***	0.17	4.07%***	0.20
Social capital				
Either parent has been in business (yes = 1)	14.61%***	0.35	16.67%***	0.37
Household member currently in business (yes = 1)	9.03%**	0.29	11.85%***	0.32
Financial capital				
Value of household assets – positive (1,000 Euro)	291.39	710.02	326.99	930.64
Value of household assets – net (1,000 Euro)	222.22	657.60	263.24	877.64
Gross income of household (Euro)	4,721.34***	3,481.26	4,796.59***	3,674.40
Control variables				
Male	59.61%***	0.49	56.30%*	0.50
Age	36.60***	0.41	36.69***	10.23
Risk taking [0, 10]	5.57***	2.24	5.79***	2.31
German citizenship	89.82%*	0.30	90.37%	0.30
Married	50.08%***	0.50	54.07%*	0.50

Notes: Mean comparison test between group of nascent entrepreneurs and employees: *** significant at 1%-level, ** significant at 5%-level, * significant at 10%-level.

Individuals who are more certain about becoming self-employed are more likely to have gained previous self-employment experience. About four percent of the nascent entrepreneurs with an intention of at least 70 percent have been self-employed previously. In order to qualify as an employee with self-employment experience, the individual had to be self-employed for at least two years between 1994 and 2002. Furthermore, about 17 percent of the nascent entrepreneurs had parents who were self-employed when they were 15 years old and about 12 percent live together with a spouse or partner (or another household member) who is currently self-employed. If the threshold is set at 50 percent, both values are slightly lower. Regarding financial capital, the average monthly household income of nascent entrepreneurs was 4,800 Euro, about 600 Euro more than employees who did not attempt to start a business. The value of household assets does not significantly differ between nascent entrepreneurs and the control group of employees. Nevertheless, financial assets are slightly higher for nascent entrepreneurs.

Miscellaneous variables

The empirical models also control for age, gender, risk behavior, marital status, and German citizenship. Nascent entrepreneurs are more likely to be male and the average nascent entrepreneur is 37 years old. The average employee of the control group is 33 years old. In regards to gender, many studies have shown that men are more likely to become self-employed (see Wagner, 2004 or Delmar and Davidsson, 2000 for an overview). Pertaining to the impact of an individual's age on the decision to become an entrepreneur, various arguments support both negative and positive relationships (Parker, 2004: 70-72). For example, elderly employees should possess relatively more human and physical capital needed for entrepreneurship as they had time to accumulate respective knowledge and wealth. Furthermore, older people have established networks and have enlarged their ability to identify opportunities (Evans and Jovanovich, 1989; Parker, 2004; Wagner, 2004). Yet, starting a new business bears the risk of failure and bankruptcy. Therefore, it can be expected that persons will not start a business if they are close to the age of retirement. Their opportunity costs become too high while the payback period shortens. Van Praag and van Ophem (1995) found that even if the opportunity to start a business increases for

older workers, they are less willing to become self-employed. A positive curvilinear relationship between age and nascent entrepreneurship is assumed.

In 2004, questions about risk behavior were included for the first time (Dohmen et al., 2005). One question was about the general willingness to take risks, other questions were about the willingness to take risk in specific domains – car driving, financial matters, leisure and sports, career, and health. Dohmen et al. (2005) found evidence of heterogeneity across individuals. A complementary field experiment led to the conclusion that the general risk question is a good predictor of actual risk-taking behavior. According to the descriptive statistics nascent entrepreneurs are less averse to risk than employees, Starting a business is associated with risk and uncertainty, therefore, individuals with a greater pro-risk attitude are expected to have a higher likelihood to become a nascent entrepreneur. Other control variables are being married and German citizenship. Nascent entrepreneurs are less likely to be married, with only 50 percent of them married, while 62 percent of employees are married. About 90 percent of employees and nascent entrepreneurs have German citizenship. Nevertheless, eight percent of non-German citizens indicated their probability to become self-employed with at least 50 percent compared to 6 percent of the respondents with German citizenship. However, the difference is only weakly significant.

6.5 Results of the Econometric Study

Becoming an entrepreneur or being a nascent entrepreneur is a rare event. Less than seven percent of the employees in the dataset could be classified as nascent entrepreneur. Therefore, the regressions are carried out using rare events logistic regression model, which has been developed by King and Zeng (2001) (see also Wagner, 2004, 2005). The variances of the estimated coefficients were estimated with the planning region as a cluster since it can be assumed that individuals may be dependent within the planning region in which they live. It was hypothesized that the social local entrepreneurial environment influences the decision whether to engage in the start-up process or not. At first sight the results are somewhat surprising: the impact of the entrepreneurial environment depends on the threshold applied regarding the self-estimated probability to become self-employed. Applying a threshold of 50 percent, the entrepreneurial environment has a significant impact on individuals to be nascent

entrepreneurs. However, those individuals who are more certain about becoming self-employed (intention for at least 70 percent to become self-employed) are not significantly influenced by their social environment (table 6.3). The results suggest that the individuals can be greatly influenced during the beginning of the decision-making process about starting a business. Once individuals have reached their decision the social entrepreneurial environment is less important.

Table 6.3 Impact of the entrepreneurial environment

	Nascent entrepreneur (intention at least 50 %)				Nascent entrepreneur (intention at least 70 %)			
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Entrepreneurial environment								
Share new firms	0.091* (1.96)	–	–	–	0.004 (0.06)	–	–	
New firms per 1,000 inhabitants	–	0.219** (2.74)	–	–		0.065 (0.63)		
Share of small and young firms	–	–	0.047* (2.10)	–	–		0.007 (0.23)	
Small and young firms per 1,000 inhabitants	–	–	–	0.102** (3.05)				0.035 (0.83)
Control Variables								
Gender (m = 1)	0.229* (2.19)	0.232* (2.22)	0.230* (2.20)	0.232* (2.22)	0.016 (0.11)	0.017 (0.12)	0.016 (0.11)	0.017 (0.12)
Age	0.105** (4.22)	0.106** (4.21)	0.105** (4.20)	0.106** (4.19)	0.084* (2.03)	0.084* (2.03)	0.084* (2.03)	0.084* (2.03)
Age²	–0.002** (5.16)	–0.002** (5.17)	–0.002** (5.15)	–0.002** (5.14)	–0.001** (2.57)	–0.001** (2.57)	–0.001** (2.56)	–0.001** (2.57)
Risk taking [0, 10]	0.176** (7.93)	0.175** (7.88)	0.176** (7.93)	0.175** (7.87)	0.233** (6.47)	0.232** (6.46)	0.233** (6.46)	0.232** (6.46)
Married	–0.299** (2.70)	–0.289** (2.64)	–0.297** (2.69)	–0.287** (2.63)	–0.049 (0.32)	–0.043 (0.28)	–0.047 (0.31)	–0.041 (0.27)
German citizenship	–0.307 (1.95)	–0.312 (1.95)	–0.305 (1.94)	–0.308 (1.92)	–0.215 (0.91)	–0.218 (0.92)	–0.216 (0.91)	–0.217 (0.91)
Constant	–5.167** (9.37)	–5.590** (9.25)	–5.268** (9.47)	–5.673** (9.45)	–5.533** (7.03)	–5.777** (6.95)	–5.594** (7.16)	–5.853** (7.08)
Observations	9506	9506	9506	9506	9506	9506	9506	9506

Notes: Rare Events Logistic Regression, standard errors adjusted for 97 regions; ** significant at 1%-level, * significant at 5%-level

Controlling only for age, gender, marital status, citizenship, and risk behavior, each additional new firm per 1,000 inhabitants in the region where the individual lives increases the probability of being a nascent by a factor of 1.24 ($0.219e^{x}$). Each additional small and young firm per 1,000 inhabitants leads to an increase by a factor of 1.11 ($0.102e^{x}$). For explanatory purpose, person A is considered. Person A is male

and 40 years old, not married, German, and has an average risk-attitude. If he lived in the region with the lowest share of small and young firms per inhabitants, his propensity to be a nascent entrepreneur is eight percent. If he lived in the region with the highest share of small and young firms per inhabitants, his propensity would increase to 14 percent (model IV, table 6.3). Thus, the hypothesis is partly supported that individuals are particularly influenced by other entrepreneurs when facing the decision whether to start a firm or not. The more certain individuals are about their behavior, the lesser extent their decision is based on social cues. Including also variables for human, social, and financial capital, the impact of the entrepreneurial environment decreases but the effect is still significant (see table 6.4).

Similar to the entrepreneurial environment effects, human and social capital effects differ for both classifications of nascent entrepreneurs (table 6.4). The models I-III in table 6.4 classify employees as nascent entrepreneur if the self-reported intention was reported to be at least 50 percent. In this case, formal education explicitly measured by years of education only has a small positive significant effect. Each additional year of education increases the probability of being a nascent entrepreneur by a factor of 1.04 ($0.044e^{x}$). The results suggest that formal qualifications are less important than work experience. Work experience in a small firm as well as managerial experience encourages employees to attempt a start-up. Employees with both characteristics, namely individuals with managerial experience in a small company, are most likely to be nascent entrepreneurs compared to employees without any of the two experiences. Interestingly, previous entrepreneurial experience and managerial experience in a small firm seem to be substitutes. When both the small firm and managerial experience variables are excluded from the model, the coefficient for previous start-up experiences and its significance increase. It could have been assumed that the entrepreneurial environment is of less importance if the individual already worked in a small firm or even gained managerial experience in a small firm. However, the results indicate that the entrepreneurial environment as well as working in a small firm increases the individual's likelihood of starting a business.

Table 6.4 Nascent entrepreneurs: impact of entrepreneurial environment, human capital, social capital, and financial capital

	Nascent entrepreneur (intention at least 50%)			Nascent entrepreneur (intention at least70 %)		
	(I)	(II)	(III)	(IV)	(V)	(VI)
Entrepreneurial environment						
New firms per 1,000 inhabitants	–	0.170**	–	–	0.025	–
		(2.19)			(0.26)	
Small and young firms per 1,000 inhabitants	–	–	0.077**	–	–	0.017
			(2.35)			(0.41)
Human capital						
Years of education	0.044**	0.042**	0.042**	0.024	0.024	0.023
	(2.37)	(2.26)	(2.25)	(1.13)	(1.10)	(1.10)
Previous self-employment experience (yes = 1)	0.515°	0.515*	0.515*	0.877**	0.877**	0.876**
	(1.87)	(1.88)	(1.88)	(2.41)	(2.40)	(2.40)
Work experience in small firm (yes = 1)	0.337***	0.333***	0.331***	0.244	0.243	0.242
	(3.04)	(3.00)	(3.00)	(1.37)	(1.37)	(1.36)
Managerial experience (yes = 1)	0.314***	0.307***	0.306***	0.355*	0.353*	0.352*
	(2.67)	(2.60)	(2.59)	(1.80)	(1.79)	(1.78)
Managerial experience in small firm	0.519**	0.530**	0.530**	0.399	0.401	0.403
	(2.47)	(2.50)	(2.50)	(1.36)	(1.36)	(1.37)
Social capital						
Either parent has been in business (yes = 1)	0.385***	0.390***	0.389***	0.543***	0.543***	0.542***
	(2.59)	(2.61)	(2.61)	(3.22)	(3.22)	(3.21)
Household member currently in business (yes = 1)	0.110	0.109	0.110	0.558***	0.557***	0.555***
	(0.73)	(0.72)	(0.73)	(2.96)	(2.96)	(2.95)
Financial capital						
Value of household assets (1,000 Euro)	0.0001	0.0001	0.0001	–0.0005***	–0.0005***	–0.0005***
	(0.69)	(0.72)	(0.70)	(4.51)	(4.49)	(4.45)
Value of household assets² (1,000 Euro)	–2.52e-07	–2.34e-07	–2.18e-07	4.11e-06***	4.08e-06***	4.02e-06***
	(0.40)	(0.92)	(0.35)	(14.19)	(14.29)	(14.39)
Total gross income of household (1,000 Euro)	0.048***	0.047***	0.047***	0.064***	0.063***	0.063***
	(2.82)	(2.76)	(2.74)	(3.05)	(3.07)	(3.05)
Control Variables						
Gender (m = 1)	0.203	0.208**	0.208**	–0.008	–0.008	–0.007
	(1.93)	(1.98)	(1.98)	(0.06)	(0.05)	(0.05)
Age	0.081***	0.082***	0.082***	0.061	0.062	0.071
	(2.87)	(2.89)	(2.88)	(1.38)	(1.39)	(1.60)
Age²	–0.001***	–0.001***	–0.001***	–0.001**	–0.001**	–0.001**
	(4.04)	(4.07)	(4.05)	(2.02)	(2.03)	(2.27)
Risk taking [0, 10]	0.159***	0.158***	0.158***	0.211***	0.211***	0.215***
	(7.04)	(6.99)	(7.00)	(5.80)	(5.79)	(5.87)
Married	–0.338***	–0.323***	–0.322***	–0.023	–0.021	–0.064
	(2.91)	(2.82)	(2.81)	(0.14)	(0.13)	(0.40)
German citizenship	–0.472***	–0.475***	–0.471***	–0.329	–0.330	–0.354
	(3.02)	(3.01)	(2.98)	(1.39)	(1.39)	(1.49)
Constant	–4.844***	–5.538***	–5.583***	–5.548***	–5.652***	–5.846***
	(8.73)	(8.53)	(8.65)	(7.08)	(6.24)	(6.48)
Observations	9506	9506	9506	9506	9506	9506

Notes: Rare Events Logistic Regression, standard errors adjusted for 97 regions; *** significant at 1%-level, ** significant at 5%-level; * significant at 10%-level.

The results indicate that the impact of small firm and managerial experience decreases if an employee is more certain about becoming self-employed (model IV-VI). If the threshold is set at 70 percent in order to classify employees as nascent entrepreneurs, small firm experience or managerial experience hardly affect the likelihood to be a nascent entrepreneur. Nevertheless, individuals with prior self-employment experience have a higher propensity to be a nascent entrepreneur. Employees who used to be self-employed are then 2.4 ($0.877e^{x}$) times more likely to attempt another start-up than employees without prior self-employment experience. This finding is consistent with Davidsson and Honig (2003). According to their analysis, individuals with previous start-up experience are twice as likely to be a nascent entrepreneur as others. Therefore, previous experience in self-employment does not discourage attempting another start-up – it encourages such behavior. On the contrary, analyzing the PSED survey Kim et al. (2007) found individuals who were involved in previous start-ups to be less likely to take part in another formation of a business.

The results support the hypothesis that social capital is positively associated with nascent entrepreneurship. Employees whose parents have been self-employed are more likely to attempt starting a business compared to others. The probability increases with the self-reported intention to become self-employed. The results confirm that children of self-employed parents often follow the footsteps of their parents and attempt to start a business. Interestingly, if a household member is currently self-employed, the probability to be a nascent entrepreneur also increases. However, the positive relationship only exists for those individuals who are more certain about becoming self-employed (threshold set at 70 percent). Davidsson and Honig (2003) also found that having parents in business, being encouraged by friends or family as well as having a close friend or neighbor in business increases the odds of being a nascent entrepreneur. According to their results, the strongest social capital effect is based on having close friends or neighbors, who are self-employed. Individuals fitting this profile are twice as likely to attempt to start a business compared to others.

The results for financial capital suggest that household assets are only associated with being a nascent entrepreneur if the employee is very certain about becoming

self-employed. The household income slightly increases the probability for both classifications of nascent entrepreneurs. The relationship between household income and the likelihood of being a nascent entrepreneur was not found to be positive curvilinear but rather positive monotone. Each additional 1,000 Euro of monthly gross household-income increases the probability of being a nascent by a factor of 1.05 ($0.048e^{x}$). The log odds indicate that the effect is almost negligible. Nevertheless, starting a firm does not necessarily require a great value of financial resources. Individuals do not have a higher probability to attempt starting a business just because they own a house, hold stocks, or insurances. Additionally, most start-ups are small and set up in retail or service related industries with little financial capital needed. Financial resources are not the most important factor determining the likelihood of being a nascent entrepreneur.

Among the control variables, the impact of risk behavior confirms the expectations. Individuals who are more willing to take risks are more likely to attempt a start-up than risk-averse employees. Furthermore, the effect of risk behavior is stronger for the group of nascent entrepreneurs when the threshold is set at 70 percent. None of the other control variables are significant for the 70 percent group. Regarding the 50 percent group of nascent entrepreneurs, the difference between women and men to pursue self-employment is not very strong. Men have a higher propensity than women to be a nascent entrepreneur. Interestingly, the gender effect is stronger and more significant as long as the model does not include variables for human, social, and financial capital (table 6.3). As soon as women have gained managerial experience, small firm experience, or their parents were self-employed they do not have a significantly lower likelihood of being a nascent entrepreneur. The relationship between age and nascent entrepreneurship is positive curvilinear. Employees are most likely to be nascent entrepreneurs at the age of 41 and the probability decreases there after. Being married and having a German citizenship has a significant negative effect. This result suggests that especially employees with, for instance, Turkish, Italian, or Greek citizenship perceive self-employment as a valuable career option.

For explanatory purposes individual B is considered. Similar to person A he is male and 40 years old, German citizen and single. Furthermore, he and his parents

have never been self-employed; he works in a small company but has not gained any managerial experience yet, and he was educated for about 15 years. His gross income is 3,000 Euro and his financial assets are 50,000 Euro. The region he lives in has a very high share of small and young firms per inhabitants. This person is a nascent entrepreneur with a probability of 14 percent (model III, table 6.4). If he had gained managerial experience, his probability to be a nascent entrepreneur would be 27 percent. Additionally, if his parents had been self-employed, his probability would be 35 percent.

6.6 Concluding Remarks

This chapter investigated the effect of the local entrepreneurial activity; namely, the presence of new as well as young small firms on the entrepreneurial decision of individuals. I attempted to answer this question by combining individual data on nascent entrepreneurs with regional data on entrepreneurial activity. Therefore, this study complements both those studies that concentrate on individual characteristics and those which evaluate determinants of regional new firm formation activity. A pronounced level of entrepreneurial activity in the local environment may not only reduce the level of ambiguity associated with self-employment faced by an individual but also increase the legitimacy of this career option by signaling that running a business is a profitable source of reward.

The principal findings are fourfold. First, individuals are embedded in their local entrepreneurial environment which influences an individual especially at the beginning of the decision-making process about whether to become self-employed. Nevertheless, once the entrepreneurial desire is established the importance of role models decreases. Secondly, work and previous self-employment experience is more important than formal education for the likelihood of being a nascent entrepreneur. Particularly, an entrepreneurial attitude is related to working in a small firm with managerial responsibilities and may substitute previous self-employment experience. Thirdly, social capital is an important stimulus for nascent entrepreneurs. If either parent has been self-employed, the probability of being a nascent entrepreneur increases. Finally, the results indicate that financial assets are less important for nas-

cent entrepreneurs. Nevertheless, the findings indicate that self-employment may be more attractive for employees in higher income brackets.

In terms of policy implications, this study underlines that regions with a strong tradition of entrepreneurial activity are able to perpetuate entrepreneurship over time and across individuals. Furthermore, this chapter shed light on the black box of regional persistency of entrepreneurial activity by suggesting that individuals are most likely influenced in their entrepreneurial decision when they are not yet completely certain about becoming self-employed. Thus, the power of entrepreneurial role models and programs seem to be greater when entrepreneurial opportunities first strike these individuals.

7 Conclusion

Entrepreneurship and new firm formation are important economic phenomena. The formation of new firms is widespread throughout Germany, albeit regional differences in start-up rates exist. This thesis showed that the regional differences are highly persistent over the last 20 years. Empirical evidence demonstrated that start-up activity positively affects employment growth and economic growth in the long run. Taking these facts into account, it is worth knowing more about the individual decision to start a firm. The empirical evidence is not straightforward; however, at the very beginning of the decision-making process an entrepreneurial environment may encourage individuals to start a business. This chapter outlines the three main empirical results and sheds some light on their implications for scholars and policy makers.

7.1 Main Results

Regional new firm formation activity is path-dependent over time. Regions with relatively high rates of new firm formation in the past are most likely to experience a substantial number of start-ups in the future as well. Changes in the level of regional start-up activity, should they occur, are rather small and emerge over a long time period. Consequently, regions with a low level of entrepreneurship today can be expected to have only few start-ups in the near future. This high degree of persistence suggests that there are only weak prospects for an increase in entrepreneurial activity. The main factors that determine the level and the development of regional new firm formation are the entrepreneurial culture and the level of innovation activity. The predominance of small and young firms may foster start-up activity, because the greater the share of employees in small and young firms, the more individuals may perceive starting a firm as a career opportunity. Innovative activity in incumbent firms increases the regional knowledge stock. Consequently, more opportunities may arise that are left unexploited by incumbent firms and can be commercialized by newcomers. Nevertheless, government policy should not try to maximize the number of start-ups, but rather focus on the quality of new firms (Greene et al., 2004). Recent

literature has emphasized that large businesses, especially in innovative industries, are seedbeds of spin-offs (Klepper and Sleeper, 2005; Agarwal, et al., 2004; Klepper, 2001; Sorenson, 2003). Therefore, a sufficient level of strong innovative firms is crucial for regional development. Both small and large firms engaged in R&D activities are incubators for high-quality start-ups.

Entrepreneurship is a source of regional economic development. New firms stimulate economic growth by challenging incumbent firms and contesting their market position. In particular, those entrepreneurs who introduce new products or product processes accelerate structural change and increase regional competitiveness. Due to the fact that there are great differences in regional start-up rates, it is quite likely that these differences have significant consequences for regional development, particularly in the long run.

The creation of new firms has both immediate and long term impacts on employment growth. The short-term direct-effect of new firms lies in creating employment by their own labor demand. The long-term consequences are twofold. The first is that new businesses displace inefficient incumbents, leading to job losses. However, a second medium term consequence is that start-ups enhance the competitiveness of firms that remain in business by exerting a powerful threat upon incumbent firms. Consequently, newcomers force incumbents to improve their efficiency. Due to greater efficiency on the firm level, the region gains competitiveness, which may lead to employment growth in the long run.

According to chapter 3, the main effects become evident after six years and are maximized after eight years. The results suggest that the indirect supply-side effects of entries are more important than the amount of jobs created in the start-ups. New studies for Great Britain, the Netherlands and the United States confirm the pattern of the employment effects evident in West Germany (Mueller et al., 2007; van Stel and Suddle, 2007; Acs and Mueller, 2007). Government intervention is often motivated by a belief that entrepreneurs generate new employment. However, the quality of the market selection process is of crucial importance for the emergence of the supply-side effects of new business formation. Public policy should safeguard the efficiency of the selection process. Therefore, the failure of newcomers and market

exits should be understood as necessary elements of market process and policy should abstain from subsidizing firms to prevent them from leaving the market. Government policy should create a general framework which is oriented to competition and efficiency.

The results of chapter 4 and 5 clearly suggest a long-term relationship between entrepreneurship and economic growth. Entrepreneurship and university-industry relationships serve as a conduit for knowledge spillovers. Both prove to be vehicles for the commercialization of abundant underexploited knowledge. A well-developed regional knowledge stock is a prerequisite for regional economic performance. New knowledge needs to be generated by existing firms and research institutions before it can be exploited. The evidence underlines that both basic and applied research promotes growth. Regions with a higher level of entrepreneurship experience greater economic performance. In particular, new firm formation in innovative industries is an important mechanism to commercialize knowledge. Furthermore, university-industry co-operation serves as a transmission channel for firms to draw from university research. The more knowledge generated at universities spills into the private sector, the more those regions experience economic growth. Therefore, universities should increase the visibility of their research and firms may recognize university research as an input factor. The German government and the European Commission have already introduced various instruments to foster research partnerships and cooperation between universities, research institutes, and private businesses. Public support programs are usually conditional on being joint research projects between different actors. Policy implications regarding entrepreneurship would be to stimulate entrepreneurial awareness and to develop entrepreneurial skills. It is not sufficient to have policies on the generation of knowledge, but there need to be efforts to facilitate the commercialization of the regional knowledge stock.

Innovative start-ups tend to represent a small proportion of general new firm formation activity. Although changes in new business formation activity are small and occur slowly (chapter 2) they may be crucial for an increase in economic output. R&D activity and a well-developed entrepreneurial environment are a necessary precondition in order to raise innovative start-up activity. Chapter 5 shows that the exploitation of entrepreneurial opportunities has a positive impact on economic

growth. A rise of start-ups in knowledge and technology-intensive industries is a valuable source of economic growth. New firms in high-tech industries may reflect a higher quality and a higher probability of survival; therefore, these firms are most likely to contest the market positions of incumbent firms and amplify innovations. However, an increase in general start-up activity usually does not have the same positive impact on economic growth.

The entrepreneurial environment may influence the individual decision to start a business. The final chapter investigated the effect of the local entrepreneurial activity, namely the presence of small and young firms, on individual decision to start a venture. Individuals have a higher propensity to become entrepreneurs if they are more likely to perceive entrepreneurial opportunities and acknowledge self-employment as a feasible and viable option besides paid-employment (Lundström and Stevenson, 2005: 45). Individual characteristics and the entrepreneurial environment determine the propensity to be a nascent entrepreneur. A pronounced level of entrepreneurial activity in the local environment may influence individuals during the decision-making process as to whether to become self-employed or not. The locally embedded individual is influenced especially at the beginning of the decision-making process on starting a venture. Nevertheless, once the entrepreneurial desire has been established, the importance of role models decreases. Work experience and prior self-employment are more important than formal education for the likelihood of being a nascent entrepreneur. Particularly, an entrepreneurial attitude is related to working in a small firm with managerial responsibilities. Furthermore, individuals are most likely to follow in their parents' footsteps; children of self-employed parents have a higher propensity to be a nascent entrepreneur. On the contrary, personal financial assets prove to be less important.

7.2 Implications

Governments tend to believe that there is too little entrepreneurship, which encourages them to formulate policies to boost new venture creation. Policy makers believe that entrepreneurs create jobs and that a high level of entrepreneurship promotes economic growth. On the contrary, many economists would argue that government intervention in markets, notably the promotion of start-up activity, is only justified if

it corrects some kind of market failure. Different kinds of market failure may cause a suboptimal level of new firm formation. The unavailability or the insufficient availability of venture finance due to asymmetric information is one example of market failure that business founders often face (e.g. credit rationing). Another kind of market failure addresses the exploitation of new knowledge. The empirical evidence showed that new firm formation is an important vehicle to commercialize abundant underexploited knowledge. Basic research mostly generated in research institutions provides new knowledge that is not easily absorbed by private firms. An effective government intervention should establish and expand transfer channels from universities and research institutions to the private sector. Especially Germany lacks effective transfer channels. The empirical evidence suggests that most of the government subsidies prove to have little economic effect, particularly in the case of science parks. The purpose of science parks is to encourage spin-offs from research institutions and to transfer publicly-generated knowledge into the private sector. Consequently, research scholars and policy makers need to understand in depth the factors that encourage researchers and scientists to start a business in order to foster entrepreneurial activity in innovative industries. It is important to know the factors that determine their creation, their survival chances, and their growth potential.

Nevertheless, many governments promote entrepreneurship without focusing on correcting a market failure. Certainly, entrepreneurship and new firm formation is important but small and young firms might also possess drawbacks, they pay lower wages and they do less research and development activity than large firms. Further research is needed to analyze the consequences of entrepreneurship policies and evaluate their positive and negative effects on other market actors. At present there is little evidence that the benefits of government actions outweigh their costs.

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Figures

Tables