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Regional Entrepreneurial Opportunities in the Biotech Industry

Exploring the Transition from Award-winning Nascent Entrepreneurs to Real Start-ups

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Abstract

Knowledge of factors that determine the transition from nascent entrepreneurship into real entrepreneurship is of major importance for policies aiming to effectively stimulate start-ups. Whereas scholars concentrated on person-specific factors to explain transition probabilities, environmental characteristics have been fairly neglected. Given that entrepreneurship is a strongly localized phenomenon, this paper argues that regional entrepreneurial opportunities are a driving force behind the transition from nascent entrepreneurship to new venture creation. Based on unique data on 103 nascent entrepreneurs in the German biotechnology industry, we empirically assess the importance of regional entrepreneurial opportunities on transition probabilities. Further, we introduce a new approach to measure nascent entrepreneurship by capturing individuals that actively participate in start-up competitions and have won at least one competition. Controlling for technology and individual characteristics, we find strong support for our hypotheses relating to the significant impact of general regional opportunities, specific regional opportunities and the entrepreneurial environment for the probability of transition from award-winning nascent entrepreneurs to real start-ups.

Keywords: nascent entrepreneurship, entrepreneurial opportunities, start-ups, regional environment, biotechnology, R&D

JEL classification: L26, M13, R12

Regional Entrepreneurial Opportunities in der Biotechnologiebranche

Der Übergang vom potenziellen Gründer zur tatsächlichen Gründung

Zusammenfassung

Welche Faktoren beeinflussen maßgeblich die Wahrscheinlichkeit, dass potenzielle bzw. „werdende“ Unternehmensgründer *(nascent entrepreneurs)* ihre Gründungsabsicht tatsächlich umsetzen? Hierüber ist bislang kaum etwas bekannt. Das Wissen um die zentralen Einflussfaktoren ist jedoch von hoher Relevanz für die Ausgestaltung eines wirtschaftspolitischen Förderinstrumentariums. Existierende Studien legen einen Fokus auf personenspezifische Merkmale, lassen jedoch die regionale Komponente weitgehend unberücksichtigt. Ausgehend von der Annahme, dass Entrepreneurship stark ortsgebunden stattfindet, argumentiert der Beitrag, dass die Triebkräfte des Übergangs von *nascent entrepreneurs* zur faktischen Unternehmensgründung in regionalen Rahmenbedingungen *(regional entrepreneurial opportunities)* zu suchen sind. Diese Annahme wird anhand eines Datensatzes von 103 werdenden Gründern der deutschen Biotechnologiebranche empirisch überprüft. Dabei wird zugleich ein neues Maß der Erfassung von *nascent entrepreneurs* eingeführt. Dieses umfasst Akteure, die aktiv an einem oder mehreren Gründerwettbewerben teilgenommen haben und in mindestens einem Fall als Preisträger daraus hervorgegangen sind *(award-winning nascent entrepreneurs)*. Unter Berücksichtigung technologischer und personenspezifischer Faktoren bestätigt das ökonometrische Modell in hohem Maße die aufgestellten Hypothesen. Demnach wird die Wahrscheinlichkeit, vom potenziellen zum tatsächlichen Gründer zu werden, stark von – allgemeinen wie auch spezifischen – regionalen Rahmenbedingungen beeinflusst. Zudem kann der Einfluss einer regionalen Gründerkultur bzw. eines positiven Gründerklimas auf die Übergangswahrscheinlichkeit nachgewiesen werden.

Schlagwörter: nascent entrepreneurship, entrepreneurial opportunities, Unternehmensgründungen, regionale Rahmenbedingungen, Biotechnologie, FuE

JEL-Klassifikation: L26, M13, R12

Regional Entrepreneurial Opportunities in the Biotech Industry

Exploring the Transition from Award-winning Nascent Entrepreneurs to Real Start-ups

1 Introduction

Between 33% and 48% of aspiring entrepreneurs succeed in completing the transition from nascent entrepreneurship to new venture creation. A thorough understanding of new venture creation is an essential ingredient for effective policy measures focusing on the promotion of entrepreneurship and the support of small and medium-sized enterprises (SMEs) (Commission of the European Communities, 2005; Storey and Tether, 1998) In this context, the concept of nascent entrepreneurship has been subject to intense academic discussions in recent years (Johnston et al., 2006).

The majority of research to date has focused on factors that shape the propensity of an individuals' decision to become a nascent entrepreneur (e.g. Mueller, 2006; Reynolds, 1997; Delmar and Davidsson, 2000; Wagner and Sternberg, 2004). Yet, there is only limited knowledge in regard to determinants of entrepreneurs stepping into the subsequent gestation phase (Reynolds and Miller, 1992), i.e. the transition to real entrepreneurship. Primarily based on two exceptional data sets, the Global Entrepreneurship Monitor (GEM) and the Panel Study of Entrepreneurial Dynamics (PSED)[1] scholars have tracked and investigated the success of nascent entrepreneurs (Wagner, 2008; Parker and Belghitar, 2006; Carter et al., 1996; Van Gelderen et al., 2001; Diochon et al., 2003; Brixy and Hessels, 2010; Kessler and Frank, 2009). The majority of these studies have concentrated on the individual entrepreneurs, investigating characteristics such as gender, age, formal qualification, work experience, etc. However, as Wagners' (2004) review demonstrates, there is little persuasive evidence that such characteristics play a dominant role in explaining 'who starts and who gives up'.

Given this rather unsatisfactory conclusion, Wagner and Sternberg (2004) argue that besides personal characteristics, the entrepreneurial process is notably influenced by regional environmental factors. Stuart and Sorenson (2003) confirm this point and argue that 'some geographical areas afford more opportunities to create new ventures than others do'. However, regional dimensions (e.g., Armington and Acs, 2002; Audretsch

1 While the PSED, started in 1998, covers the USA primarily, the GEM project (Sternberg and Wennekers, 2005), started in 1999, covers 54 countries worldwide (in 2009). Both projects perform representative surveys of the adult population with the objective to measure several dimensions of entrepreneurial activity. In the annual GEM reports, the results of additional expert interviews are provided. More recently, the German Panel of Nascent Entrepreneurs (GEPANE) has been developed out of GEM data for Germany. First results are given in Brixy et al. (2010)

and Fritsch, 1994) have been fairly neglected in explaining the transition from nascent to real entrepreneurship. Yet, entrepreneurship is clearly a localized or regional phenomenon (Audretsch and Keilbach, 2007; Feldman, 2001), which creates a 'geography of opportunity' (Stuart and Sorenson, 2003). The present paper accounts for this spatial heterogeneity by arguing that entrepreneurial opportunities, are widely found in the regional environment and infrastructure and are therefore a major determinant of success of nascent entrepreneurship,

In addressing this relationship, the present paper contributes to the literature in several ways. First, we contribute to the lack of theoretical knowledge regarding the transition from nascent entrepreneurship to real start-up (Johnston et al. 2006). We aim to provide a more holistic approach in which general regional opportunities, specific regional opportunities, the entrepreneurial environment and individual characteristics of nascent entrepreneurs are considered in a joint framework. In particular, we apply findings from the literature around regional start-up rates as well as insights from urban economics and thus widen our theoretical lens on nascent entrepreneurship

Second, studies using data from the GEM and the PSED define a nascent entrepreneur as '*a person who is (alone or with others) now trying to start a new business; who expects to be the owner or part owner of the new firm, who has been active in trying to start the new and independent firm in the past 12 months'*. Given this rather vague definition, we propose a novel approach to measure nascent entrepreneurship. Similar to Kessler and Frank (2009) we apply a more narrow definition of nascent entrepreneurship by capturing individuals who explicitly communicate to stakeholders that they pursue to create a new venture and thus avoid including unserious start-up attempts. More precisely, we consider individuals as nascent entrepreneurs who actively participate in at least one publicly and/ or privately initiated start-up competition and who won at least one of these competitions ('Award-Winning Nascent Entrepreneurs' - AWNE)).

Third, knowledge of factors shaping the speed and probability of transition is a prerequisite for the development of effective support policies for start-ups. These factors are, however, likely to vary between industries, which has currently not been addressed in the respective literature. In our study we thus focus on knowledge-intensive industry, in particular the biotechnology industry. The results should, therefore provide a more solid input for policy-makers trying to foster new venture creation, specifically in emerging high-technology industries.

The paper is organized as follows. In the following section we present our theoretical framework and develop our hypotheses. Section 3 provides a brief characterization of the biotechnology industry in Germany. Section 4 describes the data collection and explains the measurement of our dependent and independent variables. Regression results are presented in section 5, while section 6 discusses the results and gives implications for policy and future research.

2 Regional Entrepreneurial Opportunities and Nascent Entrepreneurship - Conceptual Framework and Hypotheses

This section presents our framework regarding the factors that lead to the transition from nascent entrepreneurship to real entrepreneurship. In particular, we focus on three dimensions: i.) specific regional opportunities (sub-section 2.1, ii.) general regional opportunities (sub-section 2.2) and iii.) the entrepreneurial environment (sub-section 2.3).

2.1 Specific Regional Opportunities

Important regional knowledge-spillovers can be generated by the presence of R&D infrastructure, such as universities, technical colleges and research institutions (Audretsch et al., 2006). According to the knowledge spillover theory of entrepreneurship, those spillovers enhance the level of opportunities for knowledge-based start-ups, ultimately increasing the propensity for regional start-up activity. Particularly in emerging technological fields and knowledge-based industries characterized by rapid technological change as well as high uncertainty, spatial proximity to such R&D infrastructure, and technological know-how are likely to be essential (Hall et al., 2003).

Linkages to academic institutions can help (nascent) firms to acquire the most recent scientific knowledge and expertise in specific technological fields or can provide access to specific equipment not available internally (for an overview of university-based technology transfer, see, for instance, Bozeman, 2000; Markman et al., 2005). Particularly R&D intensive firms are dependent on highly specific and sophisticated equipment to perform continuous R&D. Not having access to facilities and equipment (e.g., mass spectrometers, laboratories with certain safety standards, etc.) can affect firms' development negatively and might lead to an abandonment of start-up activity. Previous research shows that particularly firms with a high R&D intensity tend to engage in cooperation with academic institutions (Arundel and Geuna, 2004; Fontana et al., 2006). Spatial proximity may act as a catalyst for the exchange of experiences and the transfer of knowledge, particularly if this knowledge is non-codified and tacit in nature (Malmberg and Maskell, 1997). However, knowledge spillovers are found to be geographically bounded (e.g., Anselin et al., 1997; Jaffe et al., 1993; Zucker et al., 1998), and it is therefore crucial for R&D intensive firms to locate in close vicinity to the sources of spillovers (Audretsch and Feldman, 1996).

Moreover, R&D infrastructure provides fertile grounds for the local concentration of high-qualified human capital. Research has shown that knowledge flows from job mobility are limited to a spatially concentrated job market (Saxenian 1991; Almeida and Kogut 1999). Also, workers with innovation-related knowledge and skills tend to choose their employers locally (Breschi and Lissoni 2001). Thus, localized knowledge spillovers are generated via the transmission and diffusion of knowledge and skills embodied in individuals (for instance, engineers or researchers). Particularly technology-

based entrepreneurship depends on the ability to recruit highly-qualified and experienced labor (Stuart and Sorenson, 2003).

There is compelling empirical evidence for the positive impact of regional R&D infrastructure and regional R&D capacity on regional firm births and in particular for start-ups in high-technology industries (Audretsch and Keilbach, 2007; Engel and Fier, 2001; Stuart and Sorenson, 2003). For example, Engel and Fier (2001) show that spatial proximity to universities is of great importance for the explanation of regional differences in high-tech start-up activities in East Germany. They also demonstrate that business incubators - as one element of specific R&D infrastructure - stimulate high-tech start-up activities around those facilities. These arguments lead us to formulate the following hypotheses:

H1a: Spatial proximity to universities is positively related to the probability of transition from nascent entrepreneurship to real start-up.

H1b: Spatial proximity to research institutes is positively related to the probability of transition from nascent entrepreneurship to real start-up.

H1c: Spatial proximity to business incubator initiatives is positively related to the probability of transition from nascent entrepreneurship to real start-up.

H1d: Local availability of R&D employees is positively related to the probability of transition from nascent entrepreneurship to real start-up.

2.2 General Regional Opportunities

A more generic dimension of regional opportunities that potentially drives a nascent entrepreneur to make the transition to new venture creation is the regional economic performance (Audretsch et al., 2006). This view assembles the basic ideas of externalities arising from agglomeration economies i.e., localization and urbanization economies.

Localization economies emphasize the importance of one or a few closely related spatially concentrated industries for regional knowledge spillovers (Arrow, 1962; Marshall, 1920; Romer, 1986). Following Marshall, a specialized labor market and specialized suppliers allowing for intra-industry linkages are key factors determining the advantages of localization economies (Marshall-Arrow-Romer (MAR) externalities). Positive returns from scale economies at the regional level create an advantage for firms that intend to (re-)locate in this region. Particularly new entrants that are constrained in their resource base are attracted to locations where the probability for receiving spillovers is highest due to industrial concentration, as recently demonstrated for Canadian biotechnology firms (Aharonson et al., 2007). Overall, industry concentration has been found to positively impact on regional entrepreneurship capital (Audretsch and Keilbach, 2007).

Second, there is the concept of urbanization economies, highlighting the benefits that a diversified economy brings to the exchange of complementary knowledge between eco-

nomic actors (Isard, 1956; Jacobs, 1969). A more diversified industrial structure may provide access to different and complementary technological knowledge beyond the individual industrial environment. Urbanization economies further underscore the benefits of the size and density of an agglomerated region. Large urban areas provide large-scale markets with a high number of potential customers and suppliers. Further, the better public infrastructure endowment (e.g., schools, hospitals, amenities) in large urban areas as well as transportation and communication infrastructure at the technological forefront should provide fertile grounds for economic growth (Combes, 2000). Audretsch and Keilbach (2007) argue that densely populated regions generate entrepreneurial opportunities much faster and provide favorable appropriability conditions. Such conditions might have positive effects on the return a nascent entrepreneur would expect when establishing a new business.

Conversely, the transition from nascent entrepreneurship to real entrepreneurship is likely to be prevented when agglomeration diseconomies dominate (Henderson, 1982; Henderson and Becker, 2000). Such diseconomies might refer to air pollution, crime, increasing social inequalities, traffic problems and so on.[2] More importantly, increased concentration of related firms in crowded regions intensifies local competition. In highly agglomerated regions essential input factors for setting up a new business, such as low-prices office space and labor, might become scarce due to local competition and might therefore be more expensive. This may have negative consequences for the decision to set up a new venture. Urban economists in particular emphasize the importance of agglomeration economies, costs of input factors and accessibility for entrepreneurial location decisions (see the overview in Figueiredo et al., 2002). We therefore derive the following hypotheses:

H2a: Industry concentration is positively related to the probability of transition from nascent entrepreneurship to real start-up.

H2b: Local market size is positively related to the probability of transition from nascent entrepreneurship to real start-up.

H2c: Accessibility of markets and urban areas is positively related to the probability of transition from nascent entrepreneurship to real start-up.

H2d: Factor prices are negatively related to the probability of transition from nascent entrepreneurship to real start-up.

2 Localization and urbanization economies must not be understood as mutually exclusive. A particular city with a high specialization in a specific industry can generate MAR-economies in this field, while at the same time a well-balanced mixture of the other industries can generate Jacobs-economies (Beaudry and Schiffauerova, 2009).

2.3 Entrepreneurial Environment

Entrepreneurship is clearly a localized or regional phenomenon (Audretsch and Keilbach, 2007; Feldman, 2001). Since all individuals are embedded in their respective entrepreneurial environment, this spatial dimension particularly becomes evident in the self-reinforcing, path-depend character of entrepreneurship (Minniti, 2005; Fritsch and Mueller, 2007). We can also observe a substantial persistency in regional start-up rates (Fritsch and Mueller, 2007; Audretsch and Keilbach, 2007), which means that the level of entrepreneurial activity across regions remains rather stable over time and can largely be explained by prior entrepreneurial activity.

These considerations suggest that regions characterized by a high degree of entrepreneurial activity establish a certain culture, which provides fertile grounds for further new venture creation. In those regions, potential entrepreneurs have a wide array of examples of successful (and unsuccessful) entrepreneurs which can supply crucial information (Mueller, 2006). Such information might relate to the availability of public support programs, information about reliable and valuable business partners (customers, suppliers, etc.), information in terms competitive environment or particularities of finance, etc. This lowers transaction costs and, according to Minniti (2005) reduces the uncertainty and ambiguity usually connected to entrepreneurial decision making. Nascent entrepreneurs may benefit of being part of a regional community of entrepreneurs sharing similar objectives, problems and experiences. Those regions bear also greater potential for accessing important production inputs. Particularly the accessibility to venture capital might be positively influenced by a local atmosphere in favor of entrepreneurial activities, since investors can draw on rich experience from past investment decision (see, for instance, Stuart and Sorenson, 2003 for the relationship between high-tech start-up rates and spatial proximity to venture capital firms).

Existing empirical evidence by Wagner and Sternberg (2004) and Mueller (2006) is in line with the ideas outlined above. Both studies identify a significant positive relationship between the entrepreneurial environment and the entrepreneurial milieu respectively (e.g., measured in terms of regional start-up rates) and the probability of being a nascent entrepreneur. Notwithstanding that both studies focus on the explanation of nascent entrepreneurship and do not consider the transition phase, based on the arguments given above, we formulate the following hypothesis:

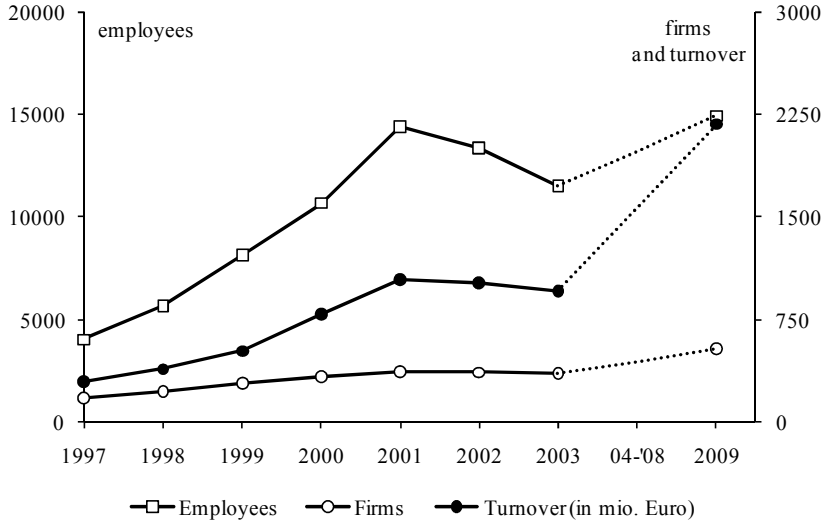
H3: A favorable entrepreneurial environment is positively related to the probability of transition from nascent entrepreneurship to real start-up.

3 The German Biotech Industry – a Short Overview

The German biotechnology industry received a major stimulus by the BioRegio competition, introduced by the Federal Ministry for Education and Research (BMBF) in 1995

to close the gap to the leading biotechnology regions in the world (Dohse, 2000). Since BioRegio was assessed as effective, further biotechnology-related contest-based programs followed, such as BioProfile, BioChance and BioFuture (Eickelpasch and Fritsch, 2005). Roughly 60% of currently operating German biotech firms were founded between 1996 to 2001. The Organisation of Economic Co-operation and Development (OECD) distinguishes between dedicated biotech firms and others. Dedicated biotech firms are defined as active enterprises, whose core objectives are the application of biotechnological procedures in the manufacturing of products, the supply of services or in the execution of biotechnological research and development. Following this narrow OECD definition, 531 firms were operating in the German biotechnology industry, generating a turnover of ca. 2.2 billion Euros with an overall employment of 14 950 in 2009. Another 114 firms are operating partially in the Biotech sector. Overall, about 30 000 employees work in the German biotech industry (BMBF 2010). Today, Germany is - behind France - the second largest industrial location for biotech in Europe.

Figure 1:
Development of the German biotech industry
- No. of firms, No. of employees and turnover in dedicated biotech enterprises - 1997-2009 -



Source: compilation by the authors; BMBF (2010); Komar (2004).

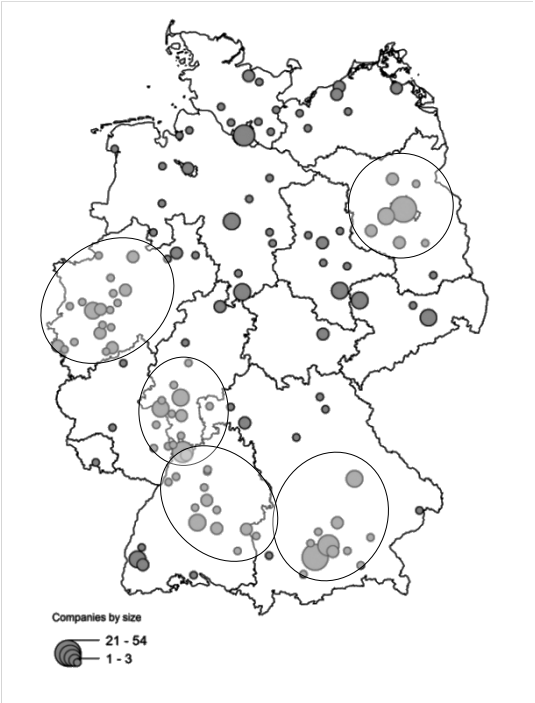
Market dynamics in the German biotech industry are still relatively high. Figure 1 shows that despite a short period of decline (2001-2003) we can observe continuous growth in the number of firms, employees and turnover (see Figure 1). The average turnover growth rate was 14.6% between 2003 and 2009. However, average firm size is comparably small: the majority of German biotechnology (87.8%) counts between 1 to 49 employees (BMBF 2010).

Like in other countries, the biotech industry in Germany is concentrated within a few regions. About 60% of all firms are located in the regions of Bavaria (Martinsried-Munich), Baden-Württemberg (Rhine-Neckar), Hesse (Frankfurt/Rhine-Main) North Rhine-Westphalia (Aachen, Cologne, Düsseldorf) and Berlin-Brandenburg (commuter belt) (see Figures 2 and 3).Bavaria is the German state with the highest number of biotech firms (105) and employees (3 279).

Figure 2:
Employees biotech-industry – 2009

Source: author's compilation; biotechnologie.de

Figure 3:
Biotech-firms - 2009

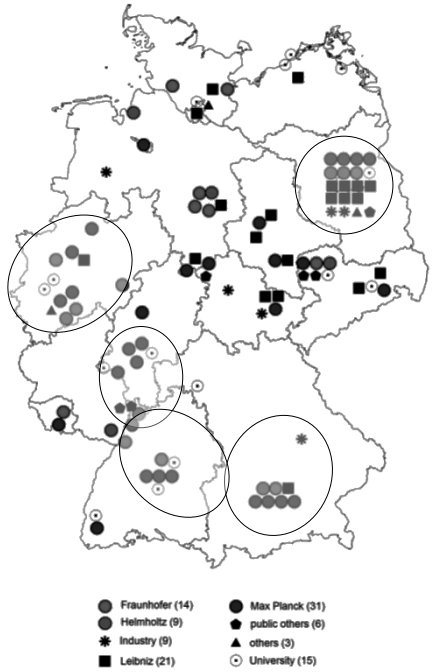


Source: author's compilation; biotechnologie.de

Similar to the USA and other European countries, the clustering of the biotech industry in Germany takes place in spatial proximity to regions characterized by high R&D intensity and scientific excellence (Aharonson et al., 2007; Corolleur et al., 2003; Stuart and Sorenson, 2003; Zucker et al., 1998) (see Figures 4 and 5). In 2009, 104 biotechnology-related research institutes were publicly funded. 63 universities and 26 universities of applied sciences[3] were active in biotechnology research (and teaching) and 9 extra-mural research institutions carried out R&D projects. According to the BMBF (2010), 26 789 researchers are active with a budget of total 2.8 billion Euros.

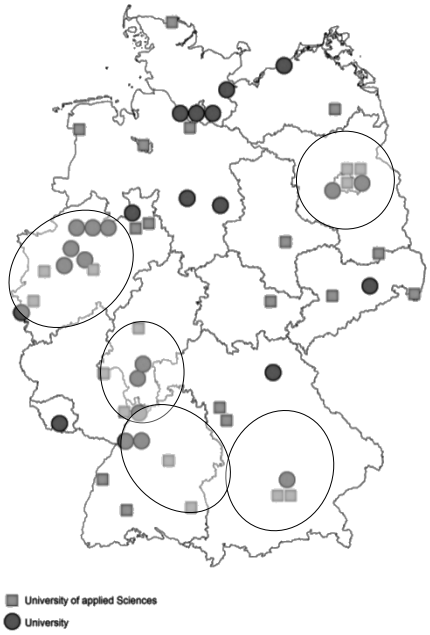
3 Universities of Applied Science' (Fachhochschulen), are a specific type of higher education institution in Germany. These technical colleges have a particular focus on teaching (predominantly in engineering) and application-oriented research. Unlike universities, they are usually not allowed to devote a doctor (PhD) degree. In the remainder of the paper, we follow Fritsch and Slavtchev (2007) and do not differentiate between universities and these technical colleges.

Figure 4:
Public Biotech R&D Institutes



Source: author's compilation; biotechnologie.de

Figure 5:
Biotech/LifeSciences related Universities



Source: author's compilation; biotechnologie.de

Since more than 50 % of total employment in biotech firms has an academic background (graduates and PhD), the congruence between scientific centers and commercial location choice comes at no surprise. Especially universities serve as key providers for qualified personnel: overall about 3 100 places for undergraduate and graduate studies in biotechnology or closely related fields are offered per year in German universities. Moreover, universities and research institutes are the most important incubator organizations for new biotech firms. In the late 1990s, about 75% of all newly established biotech ventures were spin-offs from publicly funded R&D projects (Egeln et al., 2002).

4 Data and Variable Description

We test the hypothesis formulated in section 2 within a probit framework. As our dependent variable, we use an indicator for the success of every single nascent entrepreneur $i = 1,...,N$ in starting a new business. Our explanatory variables are measures for general regional opportunities X_j^G, specific regional opportunities X_j^S and the entrepreneurial environment X_j^E which differ between the regions $j = 1,...,N$. Additionally, we control for individual characteristics X_i. Thus, our model consists of

$$y_i^* = \alpha + \beta_1 \cdot X_j^G + \beta_2 \cdot X_j^S + \beta_3 \cdot X_j^E + \beta_4 \cdot X_i + \varepsilon_i \quad \text{where } y_i = \begin{cases} 1 & if \quad y_i^* > 0 \\ 0 & otherwise \end{cases} \quad (1),$$

where $\alpha, \beta_1, \beta_2, \beta_3, \beta_4$ denote parameters and ε_i denotes an i.i.d. error component.

For estimating Equation (1), we use a data set containing information from several sources. Most regional variables stem from official statistics. Others are conducted by screening internet databases like biotechnologie.de, which is a specialized public funded platform for knowledge transfer in the field of biotechnology and life sciences.

4.1 Dependent Variable

The present study proposes a novel measure for capturing nascent entrepreneurship. As mentioned in section 3, start-up processes in high-tech industries are typically characterized by a high complexity impeding new venture creation. Responding to this situation, innovation and start-up competitions are used as policy instrument to stimulate the transition from nascent entrepreneurs to real entrepreneurship. Those start-up competitions have two key objectives: Increasing start-up probabilities by mobilizing potential founders while simultaneously increasing the probability of success of prospective start-ups. Since 2000, start-up competitions constitute an essential element of policies fostering entrepreneurship and supporting first-stage development of new-technology based firms (Dippe and Müller 2005; Kerlen and Prescher, 2010). This is the starting point of our identification strategy for nascent entrepreneurs.

Identification of nascent entrepreneurs

In the literature, nascent entrepreneurs are understood as individuals, who are trying to start new businesses, who expect to be owner of new firms and/or whose start-up did not have a positive monthly cash flow (see e.g. Wagner 2004). In contrast, we use a more narrow definition of nascent entrepreneurship:

> *Nascent entrepreneurs are defined as individuals who have successfully participated in at least one publicly or privately initiated start-up competition and who won at least one of them*.

This strategy allows for the identification of 'Award Winning Nascent Entrepreneurs' (AWNE). Applying this concept has three major advantages compared to traditionally used measures:

1. Participating in start-up competitions indicates an individuals' serious intention to start a new business. In addition, winning an award clearly indicates that the underlying business-concept (product/ service) yields at least a chance to be successful in starting the enterprise.
2. Using data from technology-oriented start-up competitions also enables us to distinguish between industries. This is important, since industry characteristics often determine how long it takes for an idea to transform into a product and how risky the process of business creation is.

3. The process of new venture creation is commonly connected to certain stages that stretch from a vague idea to a marketable product (Cooper 1990). Self-reported measures, such as those used in the GEM and PSED studies, cannot account for these different stages and are less precise, which may bias estimation results. Using the concept of AWNE allows controlling for different stages of new venture creation, which is pre-seed versus seed. Whereas pre-seed awards mainly provide proof for the technological feasibility of an idea, seed-awards support the preparation of the business model and the commencement of the business.

Overall, 103 award-winners from a total of 39 biotechnology-related start-up competitions from 2006 to 2010 were included in the present study. Those 103 AWNE are settled in 53 German NUTS-3 Regions. Table 1 gives an overview of important characteristics of these 39 competitions.

Identification of successful transitions

There is an ongoing debate how to capture the completion of transition, i.e. the realization of new venture creation and different approaches have been used and discussed in the literature (see Diochon et al., 2007; Frank and Kessler, 2009 for related discussions). For instance, first sales (Kessler and Frank, 2009) and self-reported measures (e.g. Brixy and Hessels, 2010; Carter et al., 1996; Parker and Belghitar, 2006; Diochon et al., 2003, 2007)[4] are applied to operationalize founding success.[5] To measure if an AWNE has completed the transition to new venture creation, the present study relies on data from the official Commercial Register. We define a transition as successful if an AWNE could be found in the official Commercial Register before August 2010.

4 For instance, Diochon et al. (2003:70) consider a nascent entrepreneur making the transition to new venture creation ‚when it generates a positively monthly cash flow that covers the expenses and the owner-manager salaries for more than three months.'

5 It must be noted that not all nascent entrepreneurs that do not make the transition to a real new venture can be considered as being unsuccessful. Nascent entrepreneurs that give up their idea to start a business might have realized after a certain period of testing that their business idea is not viable in practice, and therefore abandon their plan. However, it cannot be tested whether the abandonment is the result of such wisdom or a lack of creativity and commitment for problem-solving (Carter et al. 1996).

Table 1:
Awards analyzed

Name	First round	Stages*	Regional level	Frequency	Financial Life Cycle**
enable2start		2	Federal	Annual	Seed
Innovationspreis der Deutschen Wirtschaft	1980	2	Federal	Annual	Seed
Münchner Businessplanwettbewerb (MBPW)	1996	3	Supra-regional	Annual	Pre-seed/Seed
Bayerischer Gründerpreis	1997	2	State	Annual	Seed
Gründerpreis Bremerhaven	1997	3	State	Annual	Seed
Gründerpreis Thüringen (Thüringer Businessplan Wettbewerb)	1998	2	State	Annual	Pre-seed/Seed
futureSAX-Wettbewerb	1999	3	State	Annual	Pre-seed/Seed
Hochschul-Gründerpreis und Businessplan-Wettbewerb Nord-bayern	1999	2-3	City/ county	Annual	Pre-Seed/Seed
Pioniergeist	1999	2	State	Annual	Pre-seed/Seed
Existenzgründerpreis der KfW-Bankengruppe & SUPERillu	2000	1	Supra-regional	Annual	Seed
Technologietransfer-Preis Berlin-Brandenburg	2001		Supra-regional	Annual	Pre-seed
VentureCup-MV (formerly VentureSail)	2002	2	State	Annual	Pre-seed
Deutscher Gründerpreis	2002	3	Federal	Annual	Seed
Der Deutsche Innovationspreis	2003	2			Seed
GründerChampions/KfW Unternehmerpreis	2003	2	Federal	Annual	Seed
Hessischer Gründerpreis	2003	3	State	Annual	Seed
Ideenwettbewerb Gesundheitswirtschaft Schleswig-Holstein (now: Ideenwettbewerb Schleswig-Holstein)	2004	2	State	Annual	Pre-seed/Seed
Lausitzer Existenzgründer Wettbewerb (LEX)	2004	1	Supra-regional	Annual	Pre-seed/Seed
GründerCup	2004	2	City/ county	Annual	Seed
Plug & Work	2004	3	City/ county	Quarterly	Seed
Go-Bio (Funding program in competition)	2005	2	Federal	(Bi-) Annual	Pre-seed
High-Tech Gründerfonds	2005	4			Pre-seed
Businessplanwettbewerb Sachsen-Anhalt (2010 discontinued)	2005	3	State	Annual	Pre-seed/Seed
Businessplan Wettbewerb Medizinwirtschaft	2006	2	Federal	Annual	Pre-seed/Seed
Innovationspreis Region Aachen	2006	1	City/ county	Annual	Seed
Mühlheim Water Award	2006	2	Europe	Bi-annual	Seed
StartUp-Impuls	2006	1	City/ county	Annual	Seed
step Award	2006	3	Federal	Annual	Seed
Evonik European Science-to-Business Award (2009 discontin-ued)	2007	3	Europe	Annual	Pre-seed
EXIST-Forschungstransfer (Funding program in competition)	2007	2	Federal	(Bi-) Annual	Pre-Seed
Gründung.NRW	2007	2	State	Annual	Pre-seed/Seed
Bremer Gründerin des Jahres	2007	1	State	Annual	Seed
Gründerpreis Bitterfeld	2007	2	City/ county	Bi-annual	Seed
IHK-Gründerpreis Mittelfranken (Erlangen)	2007	2	City/ county	Annual	Seed
Weconomy	2007	2	Federal	Annual	Seed
WiWo-Gründerwettbewerb	2007	2	Federal	Annual	Seed
CyberChampions	2008	2	City/ county	Annual	Seed
ruhr@venture	2009	1	City/ county	Annual	Pre-seed
Lüneburger Gründerpreis (now: Leuphana Ideenpreis)	2009	1	City/ county	Annual	Pre-seed/Seed
IHK-Unternehmenspreis	2009	1	City/ county	Annual	Seed

Notes: * 1 = ‚Application and jury decision'; 2 = ‚Application, pre-selection and final round with jury decision'; 3 = 'Application, pre-selection, semi-final and final round with jury decision'; 4 = 'Business plan, term sheet, due diligence, investment decision'. ** Pre-seed = before the start-up of a company (proof of concept/phase of planning)'; Seed = establishment of start-up (businessplan and business model preparation)

Source: compilation by the authors.

4.2 Independent Variables

As specified in Equation (1), we use several variables to estimate the (i) influence of specific and (ii) general regional opportunities, (iii) the regional entrepreneurial environment. We also control for individual characteristics of the AWNE and their influence on the success of starting a new firm. Table 2 contains exact descriptions of the variable and their measurement. It needs to be noted that the spatial dimension varies between the exogenous factors, which is mainly due to data limitations: In official statistics, most of the information is aggregated on NUTS-3 level. For other variables, exact address da-

ta is available, which made is possible to identify regional endowment with certain factors using a 100 km radius from the origin of an AWNE.

Table 2:
Variable description and descriptive statistics

Variables (exp. sign)	***Definition and measurement***	***Source***	***Mean***	***Sd.***	***Min***	***Max***
Specific regional opportunities						
Universities (+)	No. of University institutes offering studies or doing research in Biotech or closely related fields within a radius 100 km	biotechnologie.de	22.49	9321	11	41
Public R&D Institutes (+)	No. of Public R&D Institutes in Biotech or closely related fields within a radius 100 km	biotechnologie.de	28.2	11	14	55
Biotech BIC (+)	No. of Biotech specialized Business Incubators (BIC) within a radius 100 km	Schwartz /Hornych (2010)	8.46	2.47	4	15
R&D Employees (+)	No. of employees in R&D/total employees (NUTS 3)	BBSR INKAR 2009	14.72	17.05	0.1	54.5
General regional opportunities						
Employees in Biotech (+)	No. of employees in Biotech or closely related fields within a radius 100 km	biotechnologie.de	2606	1257	194	4274
Population Density (+)	Inhabitants per square kilometer (km) (NUTS 3)	BBSR INKAR 2009	1545	1300	71.5	4225
Accessibility (+)	Average time to travel (car, train, airplane) to EU metropolitan areas (NUTS 3)	BBSR INKAR 2009	234.2	30.44	188	319.9
Industrial Wage (-)	Average industrial wage (€) (NUTS 3)	BBSR INKAR 2009	3530	923	1657	5546
Land Prices (-)	Average price (€) for developed land (NUTS 3)	BBSR INKAR 2009	293.6	285.3	25	1035
Entrepreneurial Environment						
High-tech Start-up rate (+)	Number of start-ups in high-technology industries /population of working age x 10.000 (NUTS 3)	Niefert et al. (2006)	4507	1865	1.63	11.28
Venture Capital (+)	No. of venture capitalists operating with focus on the respective federal state (Federal State)	bvkap.de	6786	2.22	3	11
Individual Characteristics						
Professor (-)	Dummy indicates if AWNE holds professor title	BMD-AWNE-database	0.165	0.373	0	1
PhD (reference)	Dummy indicates if AWNE holds Phd degree	BMD-AWNE-database	0.572	0.497	0	1
No. Awards (+)	No. of awards won by AWNE	BMD-AWNE-database	1165	0.544	0	3
Award Nationwide (+)	Dummy if at least one award on the national level	BMD-AWNE-database	0.651	0.479	0	1
Award statewide and local (reference)	Dummy if at least one award on the federal state or local level	BMD-AWNE-database	0.117	0.322	0	1
Award regional (reference)	Dummy if at least one award on the regional	BMD-AWNE-database	0.272	0.447	0	1
Seed Award (+/-)	Dummy if award is dedicated to seed-phase	BMD-AWNE-database	0.41	0.494	0	1
Pre-Seed Award (reference)	Dummy if award is dedicated to pre-seed-phase	BMD-AWNE-database	0.66	0.476	0	1

Source: compilation by the authors.

Specific regional opportunities

To test our hypothesis on specific regional opportunities (section 2.1), we utilize measures for the regional endowment of biotech R&D infrastructure, facilities and R&D personnel. Availability and proximity of these factors are expected to positively influence the success in the transition from AWNE to a real start-up. Thus, we introduce the number of biotech related universities (H1a) and research institutes (H1b) to our model. Additionally, the number of biotech-specialized business incubators (BIC) is applied (H1c).[6] Moreover the share of R&D personnel is used as proxy for the availability of qualified personnel (H1d).

General regional Opportunities

General regional opportunities are a set of variables that capture agglomeration economies, factor prices and accessibility measures (section 2.2). Average land prices and average industrial wages capture relative scarcity of inputs in the specific region (H2d). We thus expect them to have negative influence on transition probability. Accessibility is an aggregated measure for average time to travel (in minutes) to all 41 European metropolitan areas by car, train and airplane. It therefore covers proximity to main railway stations, airports and highways. We expect accessibility to have a negative influence on the success of transition (H2c). Population density approximates rurality or urbanity and can be seen as a measure for the local market size and urbanization economies (Audretsch and Keilbach, 2007; Audretsch and Fritsch, 1994). The higher population density, the higher should be the probability to become an entrepreneur (H2b). The number of employees in the biotech sector or closely related fields proxies localization economies (H2a). These should positively influence firm creation.

Entrepreneurial Environment

The entrepreneurial environment (H3, see section 2.3) is commonly measured using regional start-up rates (Wagner and Sternberg, 2004; Mueller, 2006). Since we are particularly interested in the culture of high-tech entrepreneurship, we test for the influence of high-tech start-up rates on the NUTS-3 level[7]. The higher these rates, the higher should be the probability for the success of transition. Additionally, high-tech start-ups are commonly reliant on venture capital. Since there are no measures for the regional acces-

6 The identification follows a definition recently put forward by Schwartz and Hornych (2010), where business incubators are defined as specialized 'if support elements and processes, as well as the selection criteria applied by the incubator management, focus on firms from solely one sector'. This paper draws upon the data from Schwartz and Hornych (2010).

7 Following the definition of technology-intensive goods by Grupp et al. (2000), the average R&D intensity of an industry is used to measure high-tech (R&D intensity above 3.5% indicates 'high-tech'). Since this definition does not include service firms, we follow the approach Metzger et al (2008) and added knowledge-based business-related services to the high-tech group. These include 'telecommunications', 'computer and related activities' (including, for instance, software consultancy or data processing), 'research and experimental development on natural sciences and engineering', 'architectural and engineering activities' and 'technical testing and analysis'.

sibility to venture capital, we introduce the number of venture capitalists which are explicitly operating in the respective federal state of the AWNE to the model. This should at least increase the chance to receive capital to start a new high-tech firm and should thus have a positive impact on business creation.

Individual characteristics of nascent entrepreneurs

Prior research indicates that nascent entrepreneurs making the transition to new venture creation are more committed or aggressive (i.e. buying facilities/ equipment, investing instead of saving money, trying to get financial support, organizing a start-up team) in making this transition compared to those individuals that give up their start-up plans (Carter et al., 1996). We therefore introduce a variable (No. Awards) trying to capture this relationship. We expect a positive impact of the number of awards a nascent entrepreneur has obtained on the transition-probability. Additionally, being winner of a national or international award can be seen as an indicator for an exceptional business idea. These awards are typically more competitive and better funded which should increase the chance to start a new firm compared to federal-statewide or regionally awarded nascent entrepreneurs. Moreover one can expect full professors to have fewer incentives in starting new businesses, meaning that higher wages and safely professional positions lead to lower effort in venture creation, compared to PhDs or others.

5 Empirical results - The Transition from Award-winning Nascent Entrepreneurs to Real Start-ups

5.1 Descriptive Results on Transition Rates

This section presents the empirical results of our analysis. While the following sub-section 5.1 briefly informs about transition rates, sub-section 5.2 presents the findings from the regression analysis.

Overall, 49 out of 103 nascent entrepreneurs (47.6%) succeeded in making the transition to a real start-up. However, we consider nascent entrepreneurs combined in a five-year period (2006, 2007, 2008, 2009 and 2010). A more detailed analysis according to the year of winning first award yields the following transition rates for a one year time-span: 42.1% (2006), 30.8% (2007), 42.1% (2008) and 50.0 % (2009). This means that 42.1% of AWNE winning an award in 2006 can be identified as operating businesses after one year. Given existing results on transition rates, as summarized in Table 3 below, our findings correspond to numbers from prior studies.

Table 3
Prior empirical findings on transition rates

					Status after one year		
Study/ authors	Country	Sample	Data	Period	Operating	Still nascent	Giving up
Brixy et al. (2010)	Germany	158	GEPANE / GEM	1 year	*42%*	*26%*	*31%*
Kessler and Frank (2009)	Austria	290	Other	3 years	*55%*	-	*45%*
Parker and Belghitar (2006)	USA	340	PSED	1 year	*33%*	*47%*	*20%*
Diochon et al. (2003) *	Canada	132	Other	1 year	*34%*	*39%*	*27%*
Van Gelderen et al. (2001)	Netherlands	330	Other	1 year	*47%*	*27%*	*26%*
Carter et al. (1996)	USA	71	Other	1 year	*48%*	*30%*	*22%*
Brixy and Hessels (2010)	Germany/ Netherlands	189	GEM	1 year	*58%*	*21%*	*21%*

Notes: Global Entrepreneurship Monitor (GEM), Panel Study of Entrepreneurial Dynamics (PSED), German Panel of Nascent Entrepreneurs (GEPANE). * Calculations excluding those 19 observations that were not identified after 12 months.

Source: Own compilation based on Parker and Belghitar (2006) and Brixy et al. (2010).

5.2 Regression Results

Table 4 displays the regressions results with respect to the determinants of the transition from nascent entrepreneurship to new venture creation.

General regional Opportunities

Considering general regional opportunities, our regression results strongly support our hypotheses that factor prices adversely affect the probability to make the transition from nascent entrepreneurship to real start-up. AWNE are significantly more likely to start a new venture in regions where land prices and average industrial wages are low. This confirms H2d. However, our estimations indicate no statistically significant relationship between our measures for local market size, industry concentration, accessibility and AWNEs' probability to the actual establishment of a new business. Hence, hypotheses H2a-H2c cannot be confirmed.

Specific regional opportunities

With respect to specific regional opportunities, the probability of transition from AWNE to real start-up neither seems to be affected by the number of geographically close located biotechnology-related research institutes nor by the number of geographically close located biotechnology-specialized business incubator organizations. This leads us to reject H1b and H1c. Yet, as hypothesized there is a significant positive effect of the number of geographically close located biotechnology-related universities, which confirms H1a. Further, our findings confirm a positive impact of regional R&D capacity on AWNEs' probability to the actual establishment of a new business (H1d).

Entrepreneurial Environment

As expected, the regional entrepreneurial environment determines a AWNEs' probability of new venture creation. Regression results show a significant positive relationship between regional start-up rates in high-technology industries and the transition probability. However, no significant relationship is found for our (comparably crude) measure of access to venture capital. Therefore, H3 can only be partially confirmed.

Table 4:
Probit Estimation Results

		Estimates		
Hypothesis	***Variables***	Coeff		SE[a]
Specific regional opportunities	***(in natural logs)***			
H1a: proximity to Universities	*Universities*	5.470	**	(2.583)
H1b: proximity to Research Institutes	*Public R&D Institutes*	-5.489		(3.406)
H1c: availability of R&D infrastructure	*Biotech BIC*	0.865		(1.188)
H1d: availability of R&D personnel	*R&D Employees*	0.617	***	(0.151)
General regional opportunities	***(in natural logs)***			
H2a: Localization Economies	*Employees in Biotech*	0.104		(0.284)
H2b: Urbanization Economies	*Population Density*	0.037		(0.209)
H2c: Access to markets/Transport Costs	*Accessibility*	-4.202		(2.688)
H2d: Factor Prices	*Industrial Wage*	-2.015	*	(1.116)
H2d: Factor Prices	*Land Prices*	-1.547	**	(0.674)
Entrepreneurial Environment	***(in natural logs)***			
H3:Entrepreneurial Culture	*High-tech Start-up rate*	0.421	**	(0.199)
H3: Entrepreneurial Culture	*Venture Capital*	0.074		(0.668)
Individual Characteristics				
	Professor	-1.393	***	(0.486)
	No. Awards	0.095		(0.466)
	Award Nationwide	0.978	***	(0.374)
	Seed Award	1.104	***	(0.409)
Technology Controls		yes		
Controls for year of first award		yes		
	Constant	40.94	**	(20.60)
	Observations	103		
	chi-square test	83.77	***	
	Pseudo R-squared	0.388		

[a] By regions clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Source: Calculation by the authors.

Individual characteristics of nascent entrepreneurs

AWNEs that are full professors are, in line with our expectations, less likely to make the step from being a nascent entrepreneur to real start-up. Although the number of awards an AWNE has obtained during the observation period has no significant impact on the transition probability, particular characteristics of the first award that has been won do have. AWNE have a significantly higher probability of success if the award is national

(compared to federal or regional) and if the award focuses on the seed-phase compared to the pre-seed phase.

6 Conclusions

The present paper makes an important contribution to the literature on nascent entrepreneurship by explicitly considering different dimensions of regional entrepreneurial opportunities on the probability of transition to real entrepreneurship. Using a novel approach to capture nascent entrepreneurs, we empirically assess the impact of i.) general regional opportunities, ii.) specific regional opportunities and iii.) the entrepreneurial environment on the transition probabilities of 103 award-winning nascent entrepreneurs in the German biotechnology industry. To the best of our knowledge, such an approach has not been proposed in the literature to date.

Whereas theoretical arguments and prior empirical findings underscore the impact of agglomeration economies on regional start-up rates/ the number of new ventures in general (see section 2.2), our findings give no evidence for a particular impact of localization and/ or urbanization economies in the process of transition from nascent to real entrepreneurship. Conversely, findings point to the inhibiting nature of agglomeration diseconomies in the transition process, regarding costs for labor and land in particular. This line of thoughts regarding the relationship between entrepreneurship and local economic structure has found its way into urban economics only recently, while being neglected for a long time (Glaeser et al., 2010a, b). Empirical results by Glaeser et al. (2010b) show that high entry costs (labor intensity, fixed costs) deter real entrepreneurship, which is clearly in line with our results. Future research should therefore intensify its efforts to investigate the interplay between such city-specific factors (agglomeration diseconomies) and transition probabilities than merely concentrating on (presumed) positive effects of localization and/ or urbanization economies.

Results show that AWNE have a higher probability to real start-up if the award focuses primarily on the seed-stage. This is an interesting finding since in the context of biotechnology policy-makers predominantly established new start-up competitions/awards focusing mainly on the pre-seed stage (BMWI, 2007). However, our study raises doubts about the effectiveness of this strategy. In contrast, competitions aiming at the pre-seed stage are less effective compared to those aiming mainly at the seed-phase. However, this is a preliminary finding, since pre-seed awards are designed to promote start-up activity in an earlier stage and business development in the biotechnology industry needs a comparably long time. For example, until a genetically developed drug comes into the market it takes up to 7 to 12 years (vfa, 2010; Miller, 2004). Since this study sheds light on the past 5 years, it should be subject to further research to investigate the long-term effectiveness of pre-seed awards.

According to our findings, specific regional opportunities and the entrepreneurial environment both can be considered important dimensions in explaining transition probabilities. More precisely, exploiting local knowledge-spillovers from nearby universities, the opportunity to tap into a dense local pool of R&D, and an established local culture supporting entrepreneurial activities seem to be catalysts for increasing the likelihood of transition. Taken together, this leads to the conclusion of a strongly path-dependent and localized character of new venture creation out of nascent entrepreneurship. Relatively poor-endowed (economically distressed) regions with a short tradition and little experiences regarding entrepreneurial activities do provide little opportunities for nascent entrepreneurs to make the step towards real business creation. Consequently, there might be only modest optimism for 'newcomer' regions.

Furthermore, it is a well-established fact that most newly-founded firms do not survive beyond five years after their establishment (Geroski, 1995). Empirical findings by Diochon et al. (2003) reveal that nearly half of the nascent entrepreneurs that are found to be an operating venture after 12 months can be considered a market exit after 24 months. Obviously, successful entry, i.e. succeeding in the transition from nascent to full entrepreneurship, is no guarantee for subsequent survival and firm growth. The main research challenge, previously raised also by Johnston et al. (2006), is therefore to explore the relationship between processes during the transition phase and (post start-up) new venture performance. Knowing such relationships would generate significant insights that could guide by governmental agencies that are concerned with the design of support programs to effectively stimulate entrepreneurship activities, both at regional and national level.

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Appendix

Table A:
AWNEs by year and field of biotechnology; summary statistics

		Summary Statistics			
Variable	***Description***	***Mean***	***Sd.***	***Min***	***Max***
nano	idea in the field of nano Biotech	0.058	0.235	0	1
green	idea in the field of green Biotech	0.049	0.216	0	1
white	idea in the field of white Biotech	0.136	0.344	0	1
maritime	idea in the field of maritime Biotech	0.214	0.412	0	1
environment	idea in the field of environmental Biotech	0.029	0.169	0	1
red	idea in the field of red Biotech	0.515	0.502	0	1
2006	first Award in the year 2006	0.185	0.390	0	1
2007	first Award in the year 2007	0.360	0.482	0	1
2008	first Award in the year 2008	0.165	0.373	0	1
2009	first Award in the year 2009	0.146	0.355	0	1
2010	first Award in the year 2010	0.136	0.344	0	1

Source: BioMitteldeutschland-AWNE-database; calculation by the authors; N=103.