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ORIGINAL RESEARCH

Regional characteristics, opportunity perception and entrepreneurial activities

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Abstract This article seeks to better understand the link between regional characteristics and individual entrepreneurship. We combine individual-level Global Entrepreneurship Monitor data for Western Germany with regional-level data, using multilevel analysis to test our hypotheses. We find no direct link between regional knowledge creation, the economic context and an entrepreneurial culture on the one side and individual business start-up intentions and start-up activity on the other side. However, our findings point to the importance of an indirect effect of regional characteristics as knowledge creation, the economic context and an entrepreneurial culture have an effect on the individual perception of founding opportunities, which in turn predicted start-up intentions and activity.

Keywords Regional entrepreneurship · Nascent entrepreneurship · Opportunity perception · Creative class · Global Entrepreneurship Monitor (GEM)

1 Introduction

Extant research clearly reveals that there are pronounced regional differences in start-up activity (e.g.,

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Armington and Acs 2002; Bosma et al. 2008; Audretsch and Fritsch 1994; Fritsch and Falck 2007; Johnson and Parker 1996), which are remarkably persistent over time (Andersson and Koster 2011; Fritsch and Mueller 2007). These findings have inspired research into the regional determinants of entrepreneurship. As individuals' entrepreneurial behavior is embedded in the broader social and spatial sphere, entrepreneurship is argued to be a "regional event" (Feldman 2001). For example, studies of demand side effects revealed a link between the regional income level (Reynolds et al. 1995) and regional population growth (Acs and Armingon 2004) on the one hand and regional start-up rates on the other. Agglomeration effects such as urbanization and localization economies can also positively affect new venture creation (Bosma et al. 2008; Krugman 1991). Other studies point to the importance of regional knowledge creation for (innovative) start-ups (Fritsch and Falck 2007; Armington and Acs 2002).

While these studies have greatly advanced our knowledge about regional determinants of entrepreneurial activity, they are less informative about the actual mechanisms through which regional characteristics affect the enterprising individual. This is because these studies usually investigate correlations between regional characteristics and regional start-up rates. However, even regional characteristics shown to be of particular importance are not strictly causal as such, but rather operate via more proximal predictors that are most likely located at the individual level (Sternberg 2009; Sternberg and Rocha 2007). We might gain a better understanding about possible mechanisms of *how* regional characteristics impact entrepreneurial behavior by combining aggregated data at the regional level with individual-level data. There is a small but growing number of studies employing this approach, with results pointing to the relevance of regional factors in explaining individuals' entrepreneurial attitudes, entrepreneurial intentions and engagement in new venture creation (e.g., Bergmann and Sternberg 2007; Mueller 2006; Wagner and Sternberg 2004; Tamásy 2006). In particular, research on the regional determinants of entrepreneurial attitudes suggests that regional characteristics can influence individual-level factors such as perceived skills to found a new venture or fear of failure preventing entrepreneurial activity (e.g., Bergmann 2005). Continuing this line of research promises to enrich our understanding of *how* the region operates and—given the numerous attempts to support entrepreneurship by government programs in all countries and at all spatial levels—can also provide knowledge for policy interventions.

In this article we set out to investigate the relationship between regional characteristics and individual entrepreneurship with a special focus on individual opportunity perception (Davidsson 2012) as an intervening variable. Integrating the individual-level variable opportunity perception into a conceptual model of regional entrepreneurship requires distinguishing between *direct* and *indirect* effects of the regional environment. Regarding the direct effects we investigate the relationship between regional characteristics and individual entrepreneurship. This is in our case captured by business start-up intentions and activity—representing early stages of the entrepreneurial process. Thereby we focus on three main regional characteristics: knowledge creation, economic conditions and entrepreneurial culture. We then turn to our main research question, the indirect effects of regional characteristics on individual entrepreneurship. In order to target the cascading down process of the regional characteristics towards the individual, we follow Sternberg and Rocha (2007), who champion a model that focuses on the individual perception of regional characteristics. This perception then triggers individual entrepreneurship. In this way regional characteristics can have an indirect effect on entrepreneurship. Based on insights from multiple disciplines, we then theorize how regional knowledge creation, economic conditions and an entrepreneurial culture affect individual opportunity perception, which in turn affects individual start-up intentions and activity.

In order to test our hypotheses we combine regional-level data (drawn from different sources, e.g., German Social Insurance Statistics) and individual-level data [drawn from the German data of the Global Entrepreneurship Monitor (GEM) for survey years 2002–2006 and 2008–2009]. Multilevel methods are used for the statistical analyses. In doing so, this article makes three contributions to the literature. First, we combine ideas from the fields of entrepreneurship research, regional economics and psychology to theorize how regional characteristics can affect individual opportunity perception. Second, our results

suggest that the effect of regional characteristics on individual entrepreneurship is indirect rather than direct. Third, by establishing a link between regional characteristics and individual opportunity perception, we add to evolutionary economic geography arguing in favor of entrepreneurship and the related opportunity perception as an evolutionary event itself.

The remainder of the article is organized as follows. In the next section our conceptual model of the direct and indirect effects of regional characteristics on individual entrepreneurship and seven related hypotheses are set out. Section 3 is dedicated to the presentation of our data, the variables and methods used. The results of our empirical analysis are presented in Sect. 4. Section 5 discusses our findings and concludes.

2 Theory and hypotheses

In this section we develop our hypotheses that comprise the empirically testable model shown in Fig. 1. We first present hypotheses on the direct effect of regional characteristics on individual entrepreneurship (in our case business start-up intentions on the one hand and engagement in business start-up activity on the other) and then turn to our main research question, the indirect effect of the regional characteristics on individual entrepreneurship via opportunity perception.

2.1 Direct effect of regional characteristics on individual entrepreneurship

Individual entrepreneurship is often modeled as occupational choice (e.g., Parker 2005) where people compare utility derived from paid employment and entrepreneurship ultimately deciding for the option offering the highest utility. Regional characteristics can directly affect this individual choice. According to the literature, the direct effect of regional characteristics on individual start-up activity and intentions can mainly be related to three characteristics of the region the potential entrepreneur lives and works in: knowledge creation, economic context and an entrepreneurial culture (Sternberg and Rocha 2007; Sternberg 2009).

One important regional determinant for entrepreneurship is the creation of opportunity-related knowledge. Knowledge can be created in various types of organizations: innovative firms, public or semi-public research institutions. It is, however, always dependent on people who are creative, i.e. who create new knowledge based upon the (re-)combination of available knowledge. Since Florida's (2004) seminal work this creation has been attributed to members of the "creative class." According to this school of thinking new venture creation is facilitated by the presence of the creative class in the region. Florida argues that members of the creative class are engaged in creative and innovative tasks in their job. Therefore they are

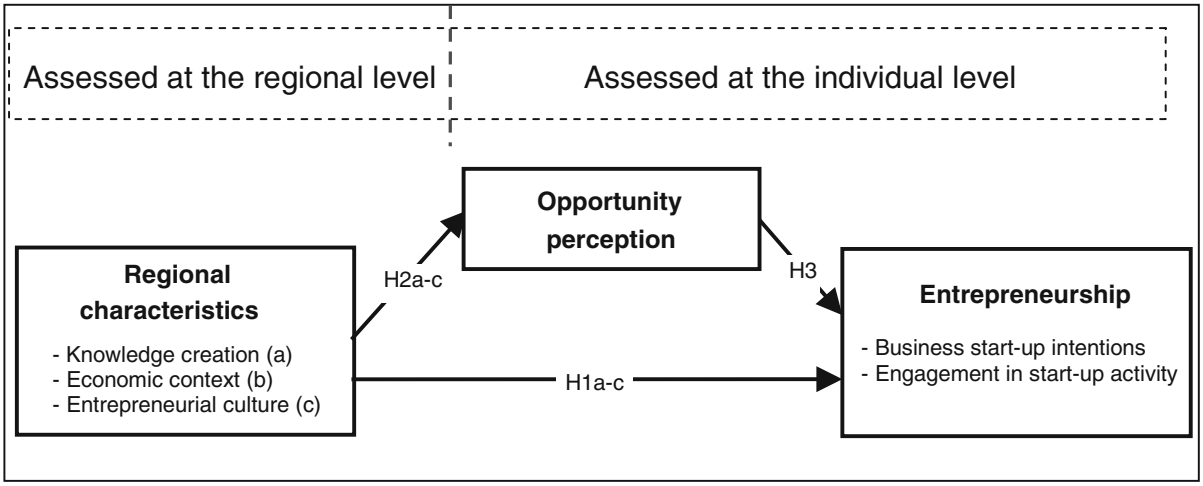

Fig. 1 Direct and indirect effects of regional characteristics on individual entrepreneurship

regarded as being key drivers for the regional development by creating knowledge that can be commercially exploited by either themselves or others by founding new businesses. Scholars outside economics have also taken up Florida's acknowledgement of the significant relationship between creativity and entrepreneurship (see, e.g., Sternberg 2004 for a psychological perspective). Some empirical analyses indeed report a positive correlation between the proportion of creative people in a region and entrepreneurial activity in studies undertaken in the US, Germany and other European countries (Boschma and Fritsch 2009; Fritsch and Stuetzer 2009; Lee et al. 2004), while others do not support Florida's hypothesizes (e.g., Hansen and Niedomysl 2009).

Hypothesis 1a A higher share of the creative class in the region—indicating more regional knowledge creation—is associated with a higher likelihood of individuals to have business start-up intentions and to engage in start-up activity.

Another important regional characteristics is the economic context, which comprises determinants like regional demand for new products, industry structure, firm size structure (absolute/relative number of small firms, attitude of large firms towards young/small firms), labor market characteristics (unemployment rate, job opportunities for highly-skilled university graduates) and many others (e.g., Bosma et al. 2008; Fritsch and Falck 2007). A relatively high regional GDP can pull people into entrepreneurship because it signals high demand for products and services (cf. Audretsch and Fritsch 1994). A relatively high share of small (and very often young) firms in a region may be interpreted as an indicator of a small-firm-friendly economic environment in the region, e.g., in terms of the procurement behavior of private and public firms. In addition, a high regional share of small firms may represent a high level of broad and balanced skills among the work force that is crucial for new venture creation (e.g., Stuetzer et al. in press; Armington and Acs 2002). If the regional labor market is characterized by a high unemployment rate, this might be negative for entrepreneurial activity, from both low- and high-skilled individuals.

Hypothesis 1b Higher GDP per capita, higher share of small firms, and a lower and shrinking unemployment rate—indicating a more favorable economic context—are associated with a higher likelihood of individuals to have business start-up intentions and to engage in start-up activity.

Finally, we turn to entrepreneurial culture as a potential determinant of entrepreneurship. According to Hofstede (2001, p. 1), culture is seen as "the collective programming of the mind that distinguishes the members of one group or category of people from another." As this programming seems to occur early in life it has important implications for the individual mindset and consequently for individual behavior (Hofstede 1980). Cultural characteristics include norms, institutions and beliefs. More explicitly, the regional images of entrepreneurs in general and new firm founders in particular as well as the perception of the local population concerning risk attitudes, business failure or economic success are examples of cultural characteristics relevant for entrepreneurship. Regions differ in terms of such cultural characteristics (e.g., Davidsson and Wiklund 1997), which can have a significant effect on start-up intentions and activity.

Cultural characteristics are often shaped by the regional industrial history. Old industrialized areas like the Ruhr valley or the so-called "rust belts" in Northeastern US or in England are characterized by very old, but (previously) large and dominant firms, which prevented new firms from growing up or even emerging ("Upa's tree effect"). In such regions the culture is rather negative for new firms and new firm founders (Wagner and Sternberg 2004; Jackson and Rodkey 1994). In addition to this, Audretsch and Keilbach's (2004) "Entrepreneurship capital" argument may be defined as a regional milieu of agents and institutions that is conducive for new venture creation. Potential new firm founders have a feeling for a region's entrepreneurship capital—if there is much of this capital, the propensity of potential founders to start a firm would be higher. In this sense, entrepreneurial capital is closely related to the domain of an entrepreneurial culture.

An entrepreneurial culture can, in principle, positively influence the intention to become an entrepreneur, the propensity to launch a new firm and the economic success of endogenous start-ups. One of the most important contributing factors to the growth of many of today's high-tech regions, particularly in the USA (Silicon Valley, Greater Boston), but also in Munich, to take a German example, is a stronger entrepreneurial dynamic than in other regions in the

same country and the same period of time (see Sternberg 2010 for an international comparison of the emergence of such high-tech regions). In particular, regions with comparatively high start-up rates demonstrate that not only favorable overall economic framework conditions but also the regional entrepreneurial and innovation climate are responsible for these high rates. Taking these arguments together, the past regional entrepreneurial start-up rate appears—via the accumulated regional entrepreneurial capital—to be a manifestation of a region's entrepreneurial culture.

Hypothesis 1c A higher start-up rate in the region—indicating a more pronounced entrepreneurial culture—is associated with a higher likelihood of individuals to have business start-up intentions and to engage in start-up activity.

2.2 Indirect effect of regional characteristics on individual entrepreneurship via opportunity perception

Because the regional characteristics described above are relatively distal to the individual, one should not expect large direct effects between knowledge creation, the economic context and an entrepreneurial culture in a region on the one side and individual entrepreneurship on the other. Moreover, these effects should not be very meaningful because regional characteristics do not cause a specific behavior. There is no such thing as an inbuilt automatism that forces people to engage in entrepreneurship. In order to target the actual cascading down process of the regional characteristics toward the individual, we build on Sternberg and Rocha (2007) who champion a model that focuses on the individual perception of regional characteristics. This perception then triggers individual entrepreneurial behavior. In this way regional characteristics can have an *indirect* effect on entrepreneurship. Similar analytic strategies are also applied in more general research on the individual-level effects of contemporary social and economic change (e.g., Obschonka et al. 2012).

These cascading down processes between the region and individual entrepreneurship are obviously quite complex and could not be covered comprehensively in this article. We therefore decided to focus on one major factor, opportunity perception, for three reasons.[1] First, a decade after Shane's and Venkataraman's (2000) landmark paper, the entrepreneurial opportunity has become the central focus in entrepreneurship research. While this has triggered much discussion on whether entrepreneurial opportunities are fundamentally objective or subjective in nature, recent theorizing has started to disentangle this construct (Shane 2012). In this article we follow Davidsson's (2012) delineation of Shane and Venkataraman's opportunity into the (1) opportunity conditions (e.g., new technologies such as the internet), (2) perception of opportunity (e.g., market needs such as accessing information contained in web pages) and (3) subjective business ideas (e.g., search engines such as Google). Opportunity perception is thereby understood as the individual assessment of a situation conducive for new economic activity. Second, Davidsson's view offers new research perspectives for economic geography by facilitating the investigation of the spatial variance in opportunity perception. Reformulating one of Shane and Venkataraman's (2000) initial research questions on the basis of Davidsson's view, it is important to understand why and how people perceive these opportunities. The role of regional characteristics in this process is under-researched and not well understood (Sternberg 2009). Third, the individual perception of entrepreneurial opportunities appears to be a central motivating factor that triggers entrepreneurial behavior (Shane et al. 2003; McMullen and Shepherd 2006). Such opportunity perception can, for example, generate entrepreneurial intentions, which in turn result in entrepreneurial activity (Krueger 2000). Some researchers argue that opportunity recognition represents an attitude measure that, according to the theory of planned behavior (Fishbein and Ajzen 2010), directly underlies entrepreneurial intentions and thus entrepreneurial behavior (Bosma and Schutjens 2011; Bergmann 2005). In our study, we focus on entrepreneurial opportunities that are perceived within the region. However, note that due to the cross-sectional nature of our individual-level data, we cannot empirically model the relation of regional characteristics and individual opportunity

[1] We also acknowledge the potential role of individual human and social capital and do not ignore these variables, but use them as control variables to check for the robustness of the indirect effects via opportunity perception.

perception as cause and effect in a traditional decision analysis. Thus, we treat knowledge creation, the economic context and an entrepreneurial culture in the region as contextual factors that make individual opportunity perception more likely. We present three hypotheses on these relationships below.

Opportunity-related knowledge generated by others may have an important effect on individual opportunity perception in two ways: the creation of knowledge that underlies opportunities and the transmission of knowledge. First, and as outlined above, members of the so-called creative class are central actors in the knowledge creation process by recombining existing knowledge in new and fruitful ways, which form the base of business ideas (Lee et al. 2004; Florida 2004). The new knowledge, however, is often not commercialized in the incumbent organizations the creative people are working in but spills over to other actors. The process of how new knowledge that is created but not commercialized through incumbent firms can serve as the basis for entrepreneurial opportunities is at the heart of the recently proposed "Theory of Knowledge Spillover Entrepreneurship" (Acs and Plummer 2005; Audretsch and Keilbach 2007). Following this line of thought, a higher share of the creative class will create more opportunity-related knowledge in the region, promoting opportunity perception by others.

Second, the creative class may also facilitate the knowledge spillover process. The knowledge spillover literature teaches us that in particular the tacit component of knowledge does not travel well, as it needs face-to-face contact for transmission and is thus bounded in space (e.g., Gertler 2003). Because these face-to-face contacts often take place in social networks, the presence of the creative class can stimulate individual opportunity perception. We know that members of the creative class differ from non-members in personality characteristics (Fritsch and Rusakova 2010). Most importantly they score higher on the extraversion trait, which indicates the level of individuals' engagement with the external world. Extraverts receive more gratification than introverts through social interaction and are thus more likely to form social relations. Indeed, longitudinal studies have shown that extraversion predicted the formation of more friendships in adolescence (Selfhout et al. 2010; Paulhus and Trapnell 1998). It also appears that extraverts have larger job-related networks than others, leading to more job switching (Vinson et al. 2007). Therefore, it seems plausible that a higher share of the creative class in a region will be accompanied by larger intraregional social networks through which opportunity-related knowledge is transmitted, ultimately facilitating individual opportunity perception. Taken together, we hypothesize:

Hypothesis 2a A higher share of the creative class in the region—indicating more regional knowledge creation—is associated with a higher likelihood of individuals to perceive opportunities.

Turning to the effect of the regional economic context, microeconomic models on occupational choice claim that people become entrepreneurs when they expect to earn more than in paid employment (e.g., Lazear 2005). Accordingly, as a contextual factor, higher regional purchasing power should make entrepreneurial activity more lucrative, making the individual perception of founding opportunities more likely (e.g., Bosma and Schutjens 2011; Bergmann 2005; Reynolds et al. 1995). A large regional share of small firms can increase the likelihood of individuals to perceive founding opportunities in several ways. Because small firms offer jobs with a more diverse range of tasks than large firms, employees can more easily acquire skills and knowledge relevant for opportunity identification (Lazear 2005; Shane 2000). A greater share of small firms also represents a larger set of network contacts, which are a crucial source of information for opportunity perception (Ma et al. 2011; Arenius and De Clerc 2005).

Regional unemployment can be detrimental for individual opportunity perception for several reasons. Most importantly, many see the unemployment rate as a general indicator for the state of the regional economy. Accordingly, a high regional unemployment rate can be a signal for individuals that starting a new business will not pay off and thus these individuals will probably not engage in any opportunity search behavior in the first instance. Additionally, ineffective labor market policies have the tendency to prolong unemployment (Eichhorst and Zimmermann 2007) and thus to divert the focus of the regional population away from the necessity of taking chances. We expect that this is more pronounced in regions with high unemployment where active and passive labor market instruments are used more extensively. Taken together, individuals living in regions with high or

growing unemployment will be less likely to search for and detect opportunities to start-up.

Hypothesis 2b Higher GDP per capita, higher share of small firms, and lower and shrinking unemployment rate—indicating a more favorable economic context—are associated with a higher likelihood of individuals to perceive founding opportunities.

An entrepreneurial culture may also affect individual opportunity perception. Culture seems to be persistent over time, and recent work in empirical economic history shows that this might be particularly true for cultural characteristics, which are economically beneficial. This is because institutions, norms, individual beliefs and actions as well as its economic outcomes mutually reinforce each other (Guiso et al. 2008; Jha 2008). This suggests that regions with high levels of entrepreneurship build up institutions and norms, spurring further entrepreneurial activity (Audretsch and Keilbach 2007; Minniti 2005). The literature on cluster emergence teaches us that trade associations, industry chambers and specialized consulting firms can be regarded as such institutions (Saxenian 1994; Sternberg 2010). Their strong intra-regional support networks help potential founders to recognize opportunities by bringing together regional actors from industry, science, finance and politics (Ozgen and Baron 2007). In addition, repeated entrepreneurship helps to establish norms legitimizing further entrepreneurial activity. Higher societal legitimation of entrepreneurship can manifest itself, for example, in the higher prestige of entrepreneurship as a career option or a decreased stigmatization of business failure. These in turn positively affect individual attitudes towards entrepreneurship (Etzioni 1987; Jackson and Rodkey 1994; Mueller 2006). Individuals not living in such regions will arguably be less likely to perceive or search for founding opportunities because it is not part of their individual mindset.

Hypothesis 2c A higher start-up rate in the region—indicating a more pronounced entrepreneurial culture—is associated with a higher likelihood of individuals to perceive founding opportunities.

In the final hypothesis we relate the individual perception of founding opportunities with individual entrepreneurship. As a person's entrepreneurial activity can be considered to be the extension of perceived opportunities (McMullen and Shepherd 2006), we assume that individuals who perceive entrepreneurial opportunities within the region should be, at least to a certain degree, more likely to have start-up intentions and to engage in start-up activity. This assumption refers to the motivational aspect of perceived opportunities for entrepreneurial behavior, as, for example, described by Shane et al. (2003). Past research indeed shows that the perception of opportunities triggers engagement in nascent entrepreneurship (e.g., Arenius and Minniti 2005; Tamásy 2006).

Hypothesis 3 Perceiving opportunities is associated with a higher likelihood of individuals to have business start-up intentions and to engage in start-up activity.

3 Data set and methods

In order to test our hypotheses we consider different levels of analysis at the same time. More specifically, our analysis combines primary data for individuals and secondary data for regional characteristics, drawing on different data sources. We should also note at this point that we use cross-sectional data to test our model. Arguably, relying on longitudinal data would be ideal to investigate causal mechanisms (e.g., in form of a mediation model). However, data sets featuring both a large number of observations per region and a longitudinal design to study entrepreneurial behavior were not available to us (and to our knowledge they do not exist).

3.1 Individual-level data

3.1.1 Data set and main dependent variables

At the individual level we use data from the representative adult population surveys of the Global Entrepreneurship Monitor (GEM) project in Western Germany covering 7 years (2002–2006; 2008–2009).[2] We focus on the western part of Germany, because even 20 years after German reunification considerable differences regarding entrepreneurship and economic conditions exist between the formerly separated parts of Germany (2004). This can skew important results.

[2] In 2007 Germany did not take part in the GEM 2007 cycle.

Table 1 Overview of the number of interviews of the GEM (Western Germany; 2002–2006; 2008–2009)

Years	Total interviews used	Perceived founding opportunities	Business start-up intentions	Engagement in start-up activity
2002	8,662	1,899	664	315
2003	4,396	522	425	179
2004	4,368	462	364	185
2005	5,233	649	410	209
2006	3,272	412	228	109
2008	3,856	588	245	114
2009	4,762	667	375	128
Total	34,549	5,199	2,711	1,239

A detailed description of the GEM methodology and data can be found in Reynolds et al. (2005). As Table 1 shows, the number of people randomly interviewed considerably exceeds the minimum level of 2,000 in every year per GEM country. So, for Germany, GEM data, though originally designed to study country differences, also provide the opportunity for inter-regional (sub-national level) analyses, as is demonstrated by other studies (e.g., Bergmann and Sternberg 2007).

3.1.2 *Individual-level predictors and individual-level controls*

Table 2 provides description of all individual variables. We are interested in individual entrepreneurship, in particular business *start-up intentions* and *engagement in start-up activity*. We define individuals with *start-up intentions* as those who have the expectation to start, either alone or with others, a new business within the next 3 years. This definition is more specific than the concept of latent entrepreneurship applied by Blanchflower et al. (2001) and Grilo and Irigoyen (2006) since it captures an intention but not a general preference for self-employment. In comparison, *engagement in start-up activity* involves concrete behavior and the respective individuals are often referred to as nascent entrepreneurs. We follow the standard GEM definition of nascent entrepreneurs as individuals who (1) have taken some action in the past year to create a venture, (2) expect to own at least a share of the new firm and (3) have not yet paid salaries and wages for more than 3 months (Reynolds et al. 2005).

In our conceptual framework we regard individual opportunity perception within the region as an important proximal predictor of individual's entrepreneurship. This is measured with a tailor-made GEM question of whether or not the participants *perceived founding opportunities* in the area where they live. We control for an array of other factors explaining individual entrepreneurship. Following prior research on new venture creation, we use *years of schooling* (Davidsson and Honig 2003) and *perceived entrepreneurial skills* as indicators for human capital (Arenius and Minniti 2005). *Knowing entrepreneurs* in the last 2 years prior to the interview is used as a basic indicator for social capital (Davidsson and Honig 2003). Also following past research we additionally control for the effect of *gender*, *age*, *fear of failure* and *household income* (Arenius and Minniti 2005; Tamásy 2006). We further include time dummies indicating the year of the observation.

Note that because we observe all individual-level variables at the same time our study might suffer from an endogeneity problem. For this reason, we refrain from investigating the link between intentions and activity. In order to limit endogeneity problems, we exclude those who are already engaged in new venture creation from the regressions on entrepreneurial intentions.

3.2 Regional-level data

3.2.1 *Data set*

The individual-level data described above are linked with archival regional-level data characterizing the socioeconomic environment of the respondents. Regional-level data (Table 3 provides detailed description and descriptive statistics) are drawn from various sources and are at the district level (NUTS3;

Table 2 Individual-level variables—GEM waves 2002–2006; 2008–2009 for West Germany

Variable	Definition	Individual-level Mean/SD	Aggregated at the regional level Overall/between variation
Dependent variable			
Start-up intentions	Dummy: 1 = The participant expects, alone or with others, to start a business including any type of self-employment, within the next 3 years	0.08/0.27	0.10/0.04
Engagement in start-up activity	Dummy: 1 = The participant is currently actively involved in setting up a business according to GEM definitions	0.04/0.19	0.07/0.03
Level 1 predictor and dependent variable			
Perceived founding opportunities[a]	Dummy: 1 = The participants saw good opportunities to start-up in the next sixth months in the area they live in	0.21/0.41	0.19/0.09
Level 1 controls			
Knowing other entrepreneurs	Dummy: 1 = The participants personally knew someone who had started a business within the last 2 years	0.41/0.49	0.22/0.09
Perceived entrepreneurial skills	Dummy: 1 = Participants believed to have the knowledge, skills and experience required to start a new business	0.46/0.50	0.24/0.09
Years of schooling	The measure of educational attainment is based on the harmonised categorical classification of participants' educational degree and vocational attainment We recoded this information into years of schooling to obtain a more continuous indicator for human capital. The categories of educational attainment and the respective years of schooling are: 1 = no school leaving certificate (7 years); 2 = primary or secondary school without vocational training (8 years); 3 = primary or secondary school with vocational training (10 years); secondary school without general qualification (11 years); secondary school with general qualification (13 years); post secondary degree (18 years)	12.31/3.10	1.24/0.66
Age	Age of respondents in years	42.44/12.74	4.78/1.89
Gender	Dummy: 1 = female	0.54/0.50	0.18/0.07
Fear of failure	Dummy: 1 = Participants stated the fear of failure would prevent them from starting-up	0.42/0.49	0.49/0.09
Household income	Categorical variable: 1 = less than 500 euros; 2 = 500–999 euros; 3 = 1,000–1,499 euros; 4 = 1,500–1,999 euros; 5 = 2,000–2,499 euros; 6 = 2,500–2,999 euros; 7 = 3,000–3,499 euros; 8 = 3,500–3,999 euros; 9 = 4,000 euros or more	5.56/2.22	0.92/0.43

[a] Thirteen percent of the respondents who answered the question on perceived founding opportunities answered "don't know." Following Levie (2007), we included this group into the "no" group as they behaved very similarly to them in the regressions

Kreise). The most important source is the German Social Insurance Statistics, as described in Spengler (2008), covering all employers and employees who are subject to obligatory social insurance. The choice of the district as the level of analysis needs some explanation. Arguably, NUTS3 regions are not functional regions, and the relevant regional dimension for many entrepreneurs is of a smaller size, such as municipalities. However, data for many regional characteristics are only available at the district level, forcing us to use this more rough-grained spatial dimension.

3.2.2 *Regional-level predictors and regional-level controls*

As indicated in Sect. 2, our regional characteristics (knowledge creation, economic context and entrepreneurial culture) are multifaceted, and many of their elements are hard to quantify. Often we thus do not

Table 3 Regional-level variables—various sources, West German districts

Variable	Definition	Mean	Overall/between/within variation	P10	P25	P50	P75	P90
Level 2 predictors								
Share of creative class	Share of employees in creative core occupations in percent. We adopt an updated version of Florida's (2004) original list of creative occupations. Fritsch and Rusakova (2010) provide a list of the respective occupations. Source: Social Insurance Statistics	4.13	1.96/1.95/0.22	2.42	2.85	3.59	4.87	6.32
GDP per capita	GDP per capita in euros. Source: Federal Statistical Office	26,389	10,127/10,079/1,109	17,262	19,942	23,721	29,208	40,822
Unemployment rate	Unemployment rate in percent. Source: Federal Statistical office	7.74	2.91/2.65/1.22	4.31	5.61	7.26	9.42	11.72
Change of unemployment	Percentage change in unemployment level. Source: Federal Employment Agency	1.69	14.38/2.53/14.15	−20.01	−10.81	4.33	12.08	17.94
Share of small firms	Share of plants with less than 20 employees in percent. Source: Social Insurance Statistics	91.23	1.74/1.72/0.28	88.83	90.07	91.29	92.48	93.48
Historic start-up rate	Number of start-ups per 1,000 employees. Source: Social Insurance Statistics	6.01	2.16/2.08/0.63	3.57	4.40	5.67	7.30	9.03
Level 2 controls								
Population density	Number of inhabitants per square meter	568.84	690.51/691.32/11.30	97.48	130.99	232.06	785.17	1,583
Settlement structure	Classification of German planning regions according to core cities and their population density. Binary variable: 1 = agglomeration areas; 0 = urban or rural areas. Source and further detailed information: The Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR)	0.37	0.48/0.48/0	0	0	0	1	1

We use different time lags for our regional-level variables. With respect to the start-up rate, the time lag is 24 years to the individual-level observations. Accordingly our data cover the time frame 1978–1983; 1985–1986. The time lag for all other variables is 1 year. Thus, these data refer to the time period 2001–2005; 2007–2008

measure them directly but instead rely on indicators reflecting these regional conditions. Nonetheless, we are confident that the indicators used in the present study capture these regional characteristics to a large degree. In order to limit endogeneity problems, we use time-lagged regional-level data. Regarding the indicators for the regional economic context and knowledge creation, the time lag to the corresponding individual observation is 1 year. With respect to the regional start-up rate indicating an entrepreneurial culture, we employ a longer time lag (details below).

We use the *share of the creative class* among the regional workforce as an indicator for opportunity-related knowledge creation in the region. According to Florida (2004, p. 9), it is particularly the members of the creative core for whom the "economic function is to create new ideas, new technology, and/or new creative content." For empirical studies the creative class is often operationalized via occupations. We use an updated list of creative occupations provided by Fritsch and Rusakova (2010), which takes into account criticism regarding construct validity (McGranahan and Wojan 2006). At this point, we note some difficulties of measuring the creative class on the basis of occupations. Most importantly, many of the listed occupations such as engineers, architects and computer programmers require a high level of human capital. Accordingly, Glaeser (2005) criticizes Florida for measuring not creativity but human capital. This critique is accurate to the extent that there is a high positive correlation between the share of the creative class and the share of highly educated people. However, as Boschma and Fritsch (2009, p. 393) correctly note, "it is what people actually *do*, rather than their industry affiliation or educational attainment that makes them economically productive." In this sense we do not regard the creative class as traditional human capital, but as an indicator for a specific type of knowledge creation: opportunity-related knowledge creation. We will return to this issue in the Results section when we apply robustness checks to our models.

We rely on *GDP per capita*, *share of small firms*, *unemployment rate* and *change of unemployment* in a region as indicators for the regional economic context. Employing these variables is consistent with prior work (e.g., Audretsch and Fritsch 1994; Armington and Acs 2002; Fritsch and Falck 2007), and their operationalization is straightforward.

As an indicator for entrepreneurial culture, we use the historic regional *start-up rate*.[3] All things being equal, we expect start-up rates to be ceteris paribus higher in regions with a more entrepreneurial-friendly culture, but lower in those regions lacking these attributes. In this sense, we regard start-up rates as a direct manifestation of a regional entrepreneurial culture. In a related approach, Audretsch and Keilbach (2004) use a similar measure as an indicator for regions' endowments with entrepreneurship capital. Other studies also interpret correlations between past and actual regional entrepreneurial activity as an indicator for an entrepreneurial culture (e.g., Wagner and Sternberg 2004; Andersson and Koster 2011). As recent research convincingly shows that an entrepreneurial culture can persist over long time periods, we lag the regional start-up rate by 24 years compared to the individual-level dependent variables (see Fritsch and Wyrwich 2012 for empirical evidence for Germany).[4]

Population density is used as a catch-all variable to control for various kinds of regional characteristics such as land prices, size of the labor market and availability of infrastructure. We also take into account that districts are embedded in higher order spatial units. Here we use the *settlement structure* (agglomeration vs. other areas) of the respective region (NUTS2) as an additional control.

[3] We use the Establishment History Panel of the IAB to compute start-ups at the regional level (Spengler 2008). For the technique of how to identify newly founded firms, see Fritsch and Brixy (2004). Note that in IAB databases start-ups are only taken into account if they employed at least one person, that is, subject to compulsory social insurance. This operationaliation of start-up activity deviates from GEM concepts such as Total Early-stage Entrepreneurship Activity (TEA) and arguably underestimates the level of entrepreneurial activity, because of the exclusion of entrepreneurs without employees and its focus on latter part of the entrepreneurial process. However, we use this data source because of its complete coverage providing us with a sufficient number of observations in all districts.

[4] The choice of a 24-year time lag is governed by data availability. 1978 is the earliest year regional start-up rates can be computed from the IAB Establishment History Panel. Compared with 2002—the first year GEM data were available for this article—this results in a time lag of 24 years. Note that employing any shorter time lags or averages over a certain time period does not change the regression results as regional start-up rates do not vary much over time.

3.3 Methods

Given the nature of our data, we decided to employ multilevel analysis methods. These methods have several advantages compared to single-level designs. Regarding entrepreneurship, it most importantly allows higher level contexts to be explicitly taken into account when studying individual entrepreneurship (Autio and Wennberg 2010).

Since our two dependent variables are dichotomous in nature (*start-up intentions* and *engagement in start-up activity*), we apply a random-effects model for binary responses. We further allow the intercept and in the last part of the analysis also the slope to vary across regions. We will return to this point in the Results section. Taken together, this can be formalized at the individual level (level 1) as

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right)_t = \beta_{0j} + \beta_{pj}\{\text{individual - level predictors}_t\} + \beta_{cj}\{\text{individual - level controls}_t\} + r_{ij}, \quad (1)$$

where at the regional level (level 2)

$$\beta_{0j} = \gamma_{00} + \gamma_{01}\{\text{regional - level predictors}_{t-k}\} + \gamma_{02}\{\text{regional - level controls}_{t-k}\} + \mu_{0j}, \text{ and} \quad (2a)$$

$$\beta_{pj} = \gamma_{p0} + \gamma_{p1}\{\text{regional - level predictors}_{t-k}\} + \gamma_{p2}\{\text{regional - level controls}_{t-k}\} + \mu_{pj}. \quad (2b)$$

Here π_{ij} denotes the probability of individual i to be engaged in new venture creation (or to have entrepreneurial intentions) in a region j, γ_{00} is the mean of the intercepts across regions, γ_{p0} is the mean of the slopes across regions, γ_{01}, γ_{02}, γ_{p1} and γ_{p2} are regional-level regression coefficients, and β_{pj} and β_{cj} are individual-level regression coefficients. The random part of the equation is represented by the combination of the individual-level residuals r_{ij} and the regional-level residuals μ_{0j}, μ_{pj}. In other words, regional characteristics might affect the individual-level regression by a varying individual-level intercept across regions and by varying individual-level slopes across regions. Recall that in order to limit endogeneity problems, all regional variables are time lagged as indicated by the subscript $t-k$. Regarding the indicators for the regional economic context and knowledge creation as well as the regional-level controls, $k = 1$, meaning that these variables are lagged by 1 year. With respect to an entrepreneurial culture, we employ a longer time lag with $k = 24$.

We should also note some concerns about the use of multilevel random effect models. One concern about this method lies in the existence of a sufficient number of level 1 and level 2 units. Various rules of thumbs have been proposed in the literature, recommending a minimum of 15–30 observations per unit at each level (e.g., Bryk and Raudenbush 1992; Hox 2010). However, recent evidence from simulation studies on binary outcomes suggests that point estimates are unbiased even in the extreme scenario of an average of five observations at level 1 (Clarke 2008). Despite missing observations in some variables, our data set is characterized by a minimum of four observations per NUTS3 region, while the average number of observations in the 326 NUTS3 regions is 96. Thus, this concern seems to be less of an issue for our study. Another concern arises from the rare event nature of our two dependent variables *start-up intentions* (overall rate 6 %) and *engagement in start-up activity* (overall rate 4 %). As a consequence, the majority of the year-region cells only contain respondents without entrepreneurial activity (53 % for *start-up intentions*; 64 % for *engagement in start-up activity*). This is particularly true for rural regions, which have fewer inhabitants and thus fewer study respondents. As a consequence, the assumption of a certain harmonic distribution of the error terms in a multilevel logistic model might not hold for rare event data, resulting in biased estimates. Although experts deem that this does not bias regression estimates (P.J. Clarke, personal communication, 13 August 13, 2011), we conduct a series of robustness checks to allay this concern.

The main objective of our article is to examine the indirect effect of regional characteristics on individual entrepreneurship via the individual opportunity perception. Because techniques and software for multilevel analysis are still evolving and our individual-level data are cross sectional, we are not able to apply a hard mediation test for our hypotheses. Instead we employ a three-step test strategy. First, we estimate the direct effect of the regional characteristics on individual *start-up intentions* and *engagement in start-up activity* (hypothesis 1a–c), without considering the

individual-level predictor *perceived founding opportunities*. In a second step we examine the influence of regional characteristics on individual *perceived founding opportunities* (hypotheses 2a-c). Third, we test whether *perceived founding opportunities* are associated with *start-up intentions* and *engagement in start-up activity* (hypotheses 3) by estimating a full model including *perceived founding opportunities* as an individual-level predictor. If opportunity perception indeed plays an important role in the relation between regional characteristics and individual entrepreneurship, (1) regional characteristics should be associated with this individual-level predictor, which in turn (2) should be associated with entrepreneurial intentions and engagement in new venture creation.

4 Results

4.1 Descriptive results

Tables 2 and 3 present descriptive statistics, and Table 4 shows correlations for all variables included in this study. The respondents have on average an *age* of 42 years and, regarding educational attainment, 12 *years of schooling*; 41 % of the individuals indicate *knowing entrepreneurs*. Although 21 % of the participants *perceived founding opportunities* and 46 % believe that they have the necessary *entrepreneurial skills* to start a business, entrepreneurship is a rather rare phenomenon in Western Germany as only 6 % have *start-up intentions* and 4 % of the participating individuals indicate being *engaged in start-up activities*. Aggregating the individual-level data to the regional level reveals substantive regional differences (between variation) for *start-up intentions* (0.03) as well as *engagement* (0.03) and the important variable *perceived founding opportunities* (0.10).

Turning to regional-level variables, recall that they indicate regional conditions of 1 year or 24 years (for the start-up rate) prior to the individual observations. Regarding the regional-level predictors, the average *share of creative class* in the region is 4 %, and the *start-up rate* is approximately 6 per 1,000 employees. On average the *GDP per capita* in Western German districts amounts to 26,389 euros, while the *unemployment rate* is around 8 %. The economy is dominated by small firms (91 %). Since most of the regional-level variables represent stocks rather than flows, they exhibit low variation over the time span. In regional analyses, one important concern is spatial autocorrelation, which affects all our regional-level predictors. In order to control for this bias, we include spatially lagged variables for the regional-level predictors into the model (Durbin 1960; Anselin 1988). The spatial weights are based on a matrix with the average distances of the center of each district from every other district, with a sharply declining weight of the distance. Another concern is the high correlation of the regional-level variables. Multicollinearity can result in unstable estimates of the coefficients and overestimation of the standard errors. However, examining the variance inflation factor (VIF) of the regional-level variables in each regression (maximum = 3.28; mean VIF = 2.30) indicates no presence of multicollinearity, allowing us to safely proceed with the analysis.

4.2 The direct effect of regional characteristics on individual entrepreneurship

In our first step, we examine predictors of individuals' *start-up intentions* and *engagement in start-up activity* (Table 5) to test our hypotheses 1a–c. Starting with *start-up intentions*, model 1 estimates an intercept-only model in order to investigate whether significant between-region variance exists in the dependent variable (Hox 2010). This model, without any predictors, yields an intra-class correlation of 0.019, meaning that 1.9 % of the total variance in the dependent variable *start-up intentions* can be explained by variation between regions. This suggests that the *direct* effect of the regional-level factors is practically unimportant, though a likelihood ratio test ($\chi^2 = 29.81$, $p < 0.001$) indicates that they are statistically significant.

To investigate effects of the individual-level factors, we include in model 2 the respective variables with the exception of *perceived founding opportunities* into the regression and find several significant estimates. *Perceived entrepreneurial skills* ($p < 0.001$), *years of schooling* ($p < 0.001$) and knowing *entrepreneurs* ($p < 0.001$) significantly raise the probability of having *start-up intentions*. Contrariwise, this probability is significantly lower for women ($p < 0.001$) as well as for individuals with higher *age* ($p < 0.001$), pronounced *fear of failure* ($p < 0.001$) and higher *household income* ($p < 0.001$). The inclusion of the individual-level

Table 4 Correlation matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Start-up intentions	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
(2) Engagement in start-up activity	**0.36**	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
(3) Perceived founding opportunities	**0.18**	**0.12**	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
(4) Knowing other entrepreneurs	**0.21**	**0.14**	**0.17**	–	–	–	–	–	–	–	–	–	–	–	–	–	–
(5) Perceived entrepreneurial skills	**0.25**	**0.19**	**0.14**	**0.26**	–	–	–	–	–	–	–	–	–	–	–	–	–
(6) Years of schooling	**0.07**	**0.05**	**0.12**	**0.13**	**0.16**	–	–	–	–	–	–	–	–	–	–	–	–
(7) Age	**−0.11**	**−0.04**	**−0.02**	**−0.11**	**0.10**	**0.01**	–	–	–	–	–	–	–	–	–	–	–
(8) Gender	**−0.09**	**−0.06**	**−0.12**	**−0.14**	**−0.19**	**−0.09**	**0.02**	–	–	–	–	–	–	–	–	–	–
(9) Fear of failure	**−0.15**	**−0.11**	**−0.12**	**−0.12**	**−0.24**	**−0.12**	**−0.03**	**0.12**	–	–	–	–	–	–	–	–	–
(10) Household income	**0.03**	**0.03**	**0.12**	**0.14**	**0.18**	**0.30**	**0.08**	**−0.11**	**−0.13**	–	–	–	–	–	–	–	–
(11) Share of creative class	**0.05**	**0.02**	**0.10**	**0.02**	**0.04**	**0.13**	**−0.04**	−0.01	**−0.03**	−0.01	–	–	–	–	–	–	–
(12) GDP per capita	**0.05**	**0.02**	**0.09**	0.01	**0.02**	**0.10**	**−0.03**	−0.01	**−0.02**	**−0.02**	**0.68**	–	–	–	–	–	–
(13) Unemployment rate	**0.01**	0.01	**−0.06**	0.01	−0.00	**0.02**	0.01	0.00	0.00	**−0.09**	**0.09**	**0.06**	–	–	–	–	–
(14) Change of unemployment	0.**01**	**0.02**	**−0.02**	**0.02**	**−0.05**	**−0.06**	**−0.02**	0.00	**0.02**	**−0.01**	**0.05**	**0.02**	**−0.04**	–	–	–	–
(15) Share of small firms	**−0.02**	0.00	**−0.02**	0.01	**0.02**	**−0.06**	**0.04**	0.00	−0.00	**0.05**	**−0.40**	**−0.56**	**−0.28**	**0.06**	–	–	–
(16) Historic start-up rate	**−0.03**	−0.01	−0.01	0.01	**0.**01	**−0.06**	**0.03**	0.00	−0.00	**0.06**	**−0.49**	**−0.52**	**−0.43**	**−0.05**	**0.74**	–	–
(17) Population density	**0.05**	**0.02**	**0.07**	0.01	0.01	**0.11**	**−0.02**	−0.01	**−0.02**	**−0.04**	**0.63**	**0.69**	**0.38**	**0.07**	**−0.36**	**−0.51**	–
(18) Settlement structure	**0.03**	**0.01**	**0.06**	0.01	**0.03**	**0.07**	0.00	−0.01	**−0.03**	**0.03**	**0.37**	**0.24**	**0.18**	**0.06**	**−0.04**	**−0.23**	**0.48**

Correlation coefficients displayed in bold are significant at the 1 % level

Table 5 Direct effect of regional characteristics on individual entrepreneurship

	Dependent variable: start-up intentions			Dependent variable: engagement in start-up activity		
	Model 1 Intercept only	Model 2 Level 1 variables	Model 3 Random intercept	Model 4 Intercept only	Model 5 Level 1 variables	Model 6 Random intercept
Individual-level controls						
Perceived entrepreneurial skills	–	1.459***	1.461***	–	1.703***	1.702***
Years of schooling	–	0.033***	0.028***	–	0.021	0.021
Knowing entrepreneurs	–	0.760***	0.759***	–	0.847***	0.847***
Age	–	−0.045***	−0.045***	–	0.053**	0.053***
Age squared	–	–	–	–	−0.001***	−0.001***
Gender	–	−0.242***	−0.243***	–	−0.111	−0.111
Fear of failure	–	−0.727***	−0.723***	–	−0.870***	−0.869***
Household income	–	−0.069***	−0.065***	–	−0.041**	−0.041**
Regional-level predictors						
Share of creative class	–	–	0.017	–	–	−0.007
GDP per capita[a]	–	–	0.003	–	–	0.004
Unemployment rate	–	–	0.008	–	–	0.016
Change of unemployment	–	–	0.001	–	–	0.006
Share of small firms	–	–	0.016	–	–	0.055
Historic start-up rate	–	–	−0.022	–	–	−0.036
Regional-level controls						
Population density[a]	–	–	0.052	–	–	−0.036
Settlement structure	–	–	0.035	–	–	0.089
Spatial lagged regional-level controls						
Share of creative class	–	–	0.063	–	–	−0.094
GDP per capita[a]	–	–	−0.015	–	–	0.006
Unemployment rate	–	–	−0.024	–	–	−0.066
Change of unemployment	–	–	−0.016	–	–	−0.003
Share of small firms	–	–	−0.086	–	–	0.079
Historic start-up rate	–	–	0.083	–	–	−0.081
Time dummies						
2002	–	−0.520***	−0.105	–	0.028	−0.089
2003	–	0.105	0.508	–	0.456**	0.358
2004	–	−0.212	0.266	–	0.482**	0.377
2005	–	−0.081	0.271	–	0.426**	0.358
2006	–	−0.006	0.583	–	0.357*	0.327
2008	–	0.006	0.084	–	0.420**	0.482**
2009	–	–	–	–	–	–
Intercept	−2.803***	−1.259***	4.539	−3.328***	−4.911***	−7.687
AIC	14,965	9,076	9,079	10,674	6,662	6,681
Intra-class correlation	0.019	0.011	0.006	0.014	0.001	0.000
Likelihood ratio test versus logistic regression	29.81***	5.50**	1.66	9.77***	0.07	0.00
Likelihood ratio test of random intercept	–	–	25.13*	–	–	8.99

Table 5 continued

	Dependent variable: start-up intentions			Dependent variable: engagement in start-up activity		
	Model 1 Intercept only	Model 2 Level 1 variables	Model 3 Random intercept	Model 4 Intercept only	Model 5 Level 1 variables	Model 6 Random intercept
Likelihood ratio test of random coefficient	–	–	–	–	–	–
Pseudo R^2	–	0.321	0.325	–	0.346	0.348
Cases with valid data	32,871	17,874	17,874	34,549	19,114	19,114
Cases with missing data	439	15,436	15,436	0	15,435	15,435
Total observations in data set	33,310	33,310	33,310	34,549	34,549	34,549

Multilevel logistic regression; *** (**, *) denotes a significance level of 0.1 % (1, 5 %)

[a] The coefficient has been multiplied by 1,000 for presentation purposes

variables explained 32.1 % of the variance[5] and substantially reduces the intra-class correlation. However, a likelihood ratio test ($\chi^2 = 5.50$, $p < 0.01$) indicates that a significant part of the variance that resides in the regional structure is still left unexplained.

Such unexplained variance is a precondition for including regional-level variables into the regression. Accordingly, model 3 (pseudo $R^2 = 0.325$) allows the intercept of the individual-level regression to vary across regions. Contrary to expectations, none of the regional-level variables has a significant effect on the likelihood of having *start-up intentions*. Replicating these regressions for the *engagement in start-up activity* as a dependent variable yields quite similar results in models 4–6, which we thus do not discuss in detail. Taken together, in our data we find no support for hypotheses H1a, H1b and H1c. Regional characteristics appear not to have a *direct* effect on individual entrepreneurship.

4.3 The indirect effect of regional characteristics on individual entrepreneurship

In this section, we investigate the *indirect* effect of regional characteristics on individual entrepreneurship via individual opportunity perception. As described in Sect. 3.3, the second step of the analysis deals with the hypothesized link of knowledge creation (H2a), the economic context (H2b) and entrepreneurial culture (H2c) on individual opportunity perception.[6] The regression results are depicted in Table 6. Again, model 1 estimates an intercept-only model to assess the between-region variance in the dependent variable. The results reveal a significant ($\chi^2 = 249.39$, $p < 0.001$) intra-class correlation of 3.9 %, which only slightly decreases when we consider the individual-level controls in model 2 (pseudo $R^2 = 0.110$). In model 3 we regard the effect of the regional-level variables in a random intercept setting, leading to a significant improvement of the model's explanatory power (pseudo $R^2 = 0.138$). With respect to knowledge creation, a higher *share of the creative class* ($p < 0.001$) significantly raises the likelihood of an individual to *perceive founding opportunities*, which gives support to hypothesis 2a. This result is in line with the general predictions from creative class theory (Florida 2004; Lee et al. 2004). It is also in line with the economic geography literature on the regional embeddedness and regional specificity of knowledge creation processes (localized capabilities in the sense of Maskell and Malmberg 1999).

Regarding the economic context, individuals in regions with a low *unemployment rate* ($p < 0.01$) are significantly more likely to *perceive founding opportunities*. This fits nicely with more general research on

[5] In order to compute the pseudo R^2 in a multilevel setting, we follow recommendations of Snijders and Bosker (1999). According to them R^2 is calculated by dividing the variance of the predicted residuals of the estimated model by the sum of (1) the variance of predicted residuals of the estimated model, (2) the level-2 variance and (3) the level-1 variance, which is equal to $\pi^2/3$ in a logistic model.

[6] As this variable is now a dependent variable (instead of an individual-level predictor), we do not test a random coefficient model.

Table 6 Effect of regional characteristics and individual opportunity perception

	Dependent variable: perceived founding opportunities		
	Model 1 Intercept only	Model 2 Level 1 variables	Model 3 Random intercept
Individual-level controls			
Perceived entrepreneurial skills	–	0.337***	0.339***
Years of schooling	–	0.042***	0.039***
Knowing entrepreneurs	–	0.600**	0.597**
Age	–	−0.004***	−0.004***
Gender	–	−0.356***	−0.356***
Fear of failure	–	−0.406***	−0.401***
Household income	–	0.066***	0.064***
Regional-level predictors			
Share of creative class	–	–	0.060***
GDP per capita[a]	–	–	0.008*
Unemployment rate	–	–	−0.052**
Change of unemployment	–	–	0.001
Share of small firms	–	–	−0.017
Historic start-up rate	–	–	0.045*
Regional-level controls			
Population density[a]	–	–	0.081
Settlement structure	–	–	0.149**
Spatial lagged regional-level controls			
Share of creative class	–	–	0.010
GDP per capita[a]	–	–	−0.007
Unemployment rate	–	–	−0.053*
Change of unemployment	–	–	0.002
Share of small firms	–	–	−0.005
Historic start-up rate	–	–	−0.058
Time dummies			
2002	–	0.132*	0.190
2003	–	−0.190*	−0.092
2004	–	−0.323***	−0.149
2005	–	−0.107	0.093
2006	–	0.064	0.396
2008	–	0.419***	0.550***
2009	–	–	–
Intercept	−1.414***	−2.233***	0.157
AIC	25,049	18,648	18,522
Intra-class correlation	0.039	0.034	0.005
Likelihood ratio test versus logistic regression	249.39***	133.17***	5.42*
Likelihood ratio test of random intercept	–	–	153.85***
Pseudo R^2	–	0.110	0.138
Cases with valid data	24,435	19,061	19,061
Cases with missing data	10,114	15,488	15,488
Total observations in data set	34,549	34,549	34,549

Multilevel logistic regression; *** (**, *) denotes a significance level of 0.1 % (1, 5 %)

[a] The coefficient has been multiplied by 1,000 for presentation purposes

Table 7 Effect of opportunity perception on individual entrepreneurship

	Dependent variable: Start-up intentions			Dependent variable: Engagement in start-up activity		
	Model 1 Level 1 variables	Model 2 Random intercept	Model 3 Random coefficient	Model 4 Level 1 variables	Model 5 Random intercept	Model 6 Random coefficient
Individual-level predictors						
Perceived founding opportunities	0.677***	0.665***	0.666***	0.636***	0.638***	0.625***
Individual-level controls						
Perceived entrepreneurial skills	1.432***	1.434***	1.434***	1.661***	1.659***	1.659***
Years of schooling	0.029**	0.024*	0.024*	0.016	0.017	0.017
Knowing entrepreneurs	0.695***	0.696***	0.696***	0.773***	0.774***	0.775***
Age	−0.044***	−0.044***	−0.044***	0.062**	0.062**	0.062***
Age squared	–	–	–	−0.001***	−0.001***	−0.001***
Gender	−0.200**	−0.199**	−0.199**	−0.082	−0.082	−0.082
Fear of failure	−0.680***	−0.678***	−0.678***	−0.811***	−0.811***	−0.813***
Household income	−0.077***	−0.073***	−0.073***	−0.047**	−0.047**	−0.046**
Regional-level predictors						
Share of creative class	–	0.014	0.014	–	−0.013	−0.013
GDP per capita[a]	–	0.002	0.002	–	0.003	0.003
Unemployment rate	–	0.016	0.016	–	0.020	0.020
Change of unemployment	–	0.002	0.002	–	0.006	0.006
Share of small firms	–	0.019	0.019	–	0.054	0.053
Historic start-up rate	–	−0.028	−0.028	–	−0.043	−0.043
Regional-level controls						
Population density[a]	–	0.030	0.030	–	−0.056	−0.052
Settlement structure	–	0.025	0.024	–	0.072	0.064
Spatial lagged regional-level controls						
Share of creative class	–	0.067	0.067	–	−0.086	−0.078
GDP per capita[a]	–	−0.015	−0.015	–	0.004	0.002
Unemployment rate	–	−0.019	−0.019	–	−0.056	−0.053
Change of unemployment	–	−0.015	−0.015	–	0.004	0.004
Share of small firms	–	−0.076	−0.075	–	0.076	0.075
Historic start-up rate	–	0.087	0.087	–	−0.066	−0.063
Time dummies						
2002	−0.515***	−0.112	−0.113	0.060	−0.028	−0.019
2003	0.148	0.529*	0.528*	0.516***	0.441	0.450
2004	−0.143	0.303	0.302	0.562***	0.474	0.482
2005	−0.036	0.280	0.279	0.480**	0.410	0.417
2006	0.018	0.553	0.551	0.398*	0.362	0.366
2008	−0.028	−0.043	−0.044	0.402**	0.439*	0.440*
2009	–	–	–	–	–	–
Intercept	−1.386***	3.224	3.169	−5.190***	−7.449	−7.616
AIC	8,931	8,938	8,942	6,561	6,581	6,584
Intra-class correlation	0.010	0.006	0.006	0.001	0.000	0.000
Likelihood ratio test versus logistic regression	4.37*	1.56	1.52	0.05	0.00	0.56

Table 7 continued

	Dependent variable: Start-up intentions			Dependent variable: Engagement in start-up activity		
	Model 1 Level 1 variables	Model 2 Random intercept	Model 3 Random coefficient	Model 4 Level 1 variables	Model 5 Random intercept	Model 6 Random coefficient
Likelihood ratio test of random intercept	–	20.88	20.73	–	8.26	8.85
Likelihood ratio test of random coefficient	–	–	0.00	–	–	0.56
Pseudo R^2	0.331	0.332	0.332	0.350	0.352	0.351
Cases with valid data	17,825	17,825	17,825	19,061	19,061	19,061
Cases with missing data	15,485	15,485	15,485	15,488	15,488	15,488
Total observations in data set	33,310	33,310	33,310	34,549	34,549	34,549

Multilevel logistic regression; *** (**, *) denotes a significance level of 0.1 % (1, 5 %)

[a] The coefficient has been multiplied by 1,000 for presentation purposes

the negative effects of social security systems on entrepreneurship. For example, in a cross-country study Hessels et al. (2008) found that countries with a higher social security contribution rate exhibited a lower incidence of entrepreneurial motivation related to taking advantage of opportunities in order to enjoy greater independence. In regions with a higher *GDP per capita* individuals are also significantly more likely to *perceive founding opportunities* ($p < 0.05$). This makes sense as economic activities are known to cluster in regions where agglomeration economies promise higher returns (e.g., Audretsch and Fritsch 1994). However, we find no significant correlation for *change of unemployment* and the *share of small firms*. Weighting this mixed evidence, we conclude that hypothesis 2b receives some support.

We further find that a higher historic *start-up rate* (24 years prior to the individual observation), indicating a regional entrepreneurial culture ($p < 0.05$), predicts individual opportunity perception, which supports hypothesis 2c. This adds to the extensive literature on direct effects of culture and entrepreneurship (e.g., Freytag and Thurik 2007; George and Zahra 2002) by pointing to one of the many possible transfer mechanisms: individual opportunity perception. Our finding is also in line with the predictions from the related entrepreneurship capital literature, emphasizing the importance of a regional milieu of agents and institutions conducive for entrepreneurial activity (Audretsch and Keilbach 2004).

The third step of the analysis tests whether or not individual *perceived founding opportunities* is positively associated with *start-up intentions* and *engagement in start-up activity* (hypothesis 3). In order to test this expectation, we replicate the first step of the analysis but include *opportunity perception* as an additional predictor. The respective results for *start-up intentions* are shown in model 1–3 (Table 7), while model 4–6 (same Table) presents the results for *engagement in start-up activity*. As expected, *perceived founding opportunities* is an important predictor for both dependent variables ($p < 0.001$, model 1 and 4). This holds true even when we include the regional-level predictors and controls in the random intercept models (model 2 and 5). Finally, we run random coefficient models (model 3 and 6). However, a likelihood ratio test suggests that the effect of opportunity perception does not differ across regions. Taken together, this suggests that regional characteristics have an indirect effect of individual entrepreneurship via individual opportunity perception.

Having tested the general relevance of regional-level predictors, the question remains, how much regional variance in *start-up intentions* and *engagement in start-up activity* can be explained by the indirect effect? In order to provide an answer, we computed predicted probabilities for *perceived founding opportunities*, *start-up intentions* and *engagement* based on our multilevel models for reasonable values of the *share of the creative class*, *GDP per capita*,

Table 8 Predicted probabilities for opportunity perception and entrepreneurship

	−2 SD	−1 SD	Mean	+1 SD	+2 SD
Share of creative class	0.1565/0.0493/0.0249	0.1726/0.0498/0.0251	0.1901/0.0504/0.0254	0.2088/0.0510/0.0257	0.2289/0.0517/0.0260
GDP per capita	0.1706/0.0498/0.0251	0.1817/0.0501/0.0253	0.1934/0.0505/0.0255	0.2056/0.0509/0.0256	0.2184/0.0513/0.0258
Unemployment rate	0.2467/0.0522/0.0263	0.2198/0.0514/0.0259	0.1950/0.0506/0.0255	0.1724/0.0498/0.0251	0.1520/0.0492/0.0248
Start-up rate	0.1678/0.0497/0.0251	0.1818/0.0501/0.0253	0.1967/0.0506/0.0255	0.2124/0.0511/0.0258	0.2291/0.0517/0.0260

Fixed effect predicted probabilities (based on regression results in model 3 in Table 7 and model 5 in Tables 5 and 6). Left: predicted probabilities to perceive founding opportunities; middle: predicted probabilities for start-up intentions; right: predicted probabilities for engagement in start-up activity. The difference of the means compared with Table 2 is due to the exclusion of the random part of the model in computing the predicted probabilities

unemployment rate and historic *start-up rate* while holding all other variables constant at their mean. The results are depicted in Table 8. For an average individual the difference in the predicted probability to perceive founding opportunities between regions with a low and a high *share of the creative class* is 7.2 % points. This translates into a difference of 0.2 % points for *start-up intentions* and 0.1 % points for individual *engagement in start-up activity*. The strongest potential indirect effects are found for the regional *unemployment rate*, where the differential between high share and low share regions is 9.5 % points for *perceived founding opportunities*, 0.3 % points for *start-up intentions* and 0.2 % points for *engagement*. With respect to regional *GDP per capita* and the historic *regional start-up rate*, the difference between prosperous and non-prosperous regions is somewhat weaker. Although these numbers may look unimpressive in absolute terms, one has to keep in mind that entrepreneurship is a rare event in Germany where a 0.3 % point difference equals roughly 10 % of the between-region variation in engagement in *engagement in start-up activity*. A regional planner should also be aware that these predicted probabilities refer to an average individual. Subgroup comparisons reveal that the reported effects of *GDP per capita* are stronger for younger people (age <40), women and highly qualified people. For older people, the potential indirect effects of the regional *share of the creative class* and regional *unemployment rate* are stronger.[7]

Our results are robust against an array of modifications. In order to meet Glaeser's (2005) critique that the creative class is a measure of human capital, we reran regressions with the share of highly qualified employees as regional-level predictor. The results reveal that the share of highly qualified employees is an equally good predictor as the share of the creative class for perceiving founding opportunities in the region. However, when both variables are simultaneously entered into the regression, the share of the creative class coefficient remains significant while the coefficient for the share of highly qualified employees turns insignificant. Another concern was the low numbers of observations at level 1 in connection with the rare event nature of our dependent variables. Analyzing a subsample containing only regions with at least 20 observations in a year did not lead to major changes in the regression results. Furthermore, applying a rare event logistic regression model with clustered standard errors also confirmed our results.[8]

5 Discussion and conclusion

The objective of our article has been to investigate the direct and indirect effect of regional characteristics (i.e., knowledge creation, economic context, entrepreneurial culture) on individual entrepreneurship. We put an emphasis on the indirect effect and developed theoretically informed hypotheses of how regional characteristics may (1) affect individual opportunity perception within the region and (2) how this opportunity perception may then affect start-up intentions and engagement in start-up activity.

[7] The respective results are available from the authors on request.

[8] Due to space constraints, we do not report these regression results, but they are available from the authors on request.

We acknowledge that this study has important limitations. First, we use a cross-sectional design so that our results must be interpreted as correlative rather than causal. This is in particular problematic as we cannot model the longitudinal nature of the entrepreneurial process by analyzing the link between start-up intentions and engagement. The cross-sectional nature of the GEM data and limitations in statistical programs also prevented us from conducting a hard mediation test of our hypotheses. However, our conceptual framework of an indirect effect between regional characteristics and individual entrepreneurship is grounded in international scholarly work and established empirical findings. Second, the present study might suffer from an endogeneity problem. We partly mitigated this problem by using time-lagged regional-level predictors and controls. Alternative indicators of an entrepreneurial culture building on individual-level values and beliefs could also help reducing endogeneity but were not available to us. A third caveat of our study is that the GEM survey often includes only a single item for constructs, which might be best measured with an item battery (e.g., opportunity perception, start-up intentions). Yet as Davidsson (2006, p. 58) states that "perfectly designed studies that reveal solid and eternal truths hardly exist in the social science." All we can do as social scientists is to try our best to understand the phenomena we are interested in and care about.

So how do we interpret the results and what is interesting? We find no empirical evidence for a direct effect of regional characteristics on individual's *start-up intentions* and *engagement in start-up activity*. This finding seems to be in conflict with studies investigating determinants of start-up rates at the regional level (Armington and Acs 2002; Reynolds et al. 1995; Fritsch and Falck 2007). However, a closer look reveals that the regional differences in our dependent variables can be largely explained by a regional composition effect—an overrepresentation of individuals of, for example, middle age groups or high income in certain regions (Bosma and Schutjens 2011). Studies controlling for such regional composition effects tend to report small and sometimes non-significant correlations between regional characteristics and entrepreneurship (Bosma and Schutjens 2011; Wagner and Sternberg 2004). Although it makes life harder for empirical research, we believe that such controls should be routinely employed—either as regional-level constructs or individual-level variables.

The apparent absence of direct effects however does not mean that regional characteristics are unimportant. Our findings point to the relevance of *indirect* effects of regional characteristics on individual entrepreneurship. Based on established theory, our results suggest that individual opportunity perception might play an important role in the cascading down process of regional characteristics towards the individual. These findings extend prior work by Sternberg and Rocha (2007), Grilo and Irigoyen (2006) and Bosma and Schutjens (2011) who initially emphasized the role of the individual perception of external characteristics as an important determinant for entrepreneurial action. Our study further contributes to evolutionary economic geography arguing in favor of entrepreneurship and the related opportunity perception as an evolutionary event itself (Stam 2010).

From a person-focused perspective, our results suggest that regional characteristics—which are objective—may operate as background (or distal) factors in that they affect proximal predictors of entrepreneurial behavior. The background factor as such may not drive entrepreneurial behavior, unless they are perceived and valued by the individual, as suggested by our results. Objective regional characteristics may drive individual regional opportunity perception, which then drives individual entrepreneurship. Nonetheless, people within the same region might differ in their perception of the same objective environment. This could have to do with a variety of personal and social factors affecting the perception and value system (e.g., personality differences). Furthermore, the perception of favorable founding opportunities in the region should not lead to entrepreneurship in every case. As discussed by Fishbein and Ajzen (2010), certain habits or identity-related individual factors may also play a role, in addition to proximal motivational factors that directly underlie intentions and behavior. Finally, possible external barriers (e.g., lack of risk capital) may prevent a person from engaging in entrepreneurship although he or she perceives regional opportunities as promising. However, some initial tests whether regional characteristics (GDP per capita, unemployment rate, etc.) moderate the link between individual opportunity perception and start-up intentions as well as engagement yield non-significant results.

We would like to conclude by pointing to implications for research that can be drawn from our findings. First, we encourage the research community to think more intensively about the cascading down process

between regional characteristics and individual entrepreneurship. This calls for a deeper investigation of how (and the conditions under which) the region affects individual intentions and engagement. Concerning the regional determinants of entrepreneurship, future research might, for example, study specific human capital variables and social capital as other possible links. For example, there are indications that regions with higher start-up rates offer the opportunity for people to acquire entrepreneurial skills (Guiso and Schivardi 2005). With respect to the theory of planned behavior, which is often used to explain start-up intentions, the impact of regional characteristics on subjective norms and perceived behavioral control might be worthwhile to study. Finally, moderation effects between individual variables and regional variables also promise new insights.

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References

Acs, Z. J., & Armingon, C. (2004). Employment growth and entrepreneurial activity in cities. *Regional Studies, 38*(8), 911–927.

Acs, Z. J., & Plummer, L. (2005). Penetrating the knowledge filter in regional economics. *Annals of Regional Science, 39*(3), 439–456.

Andersson, M., & Koster, S. (2011). Sources of persistence in regional start-up rates—Evidence from Sweden. *Journal of Economic Geography, 11*(1), 179–201.

Anselin, L. (1988). *Spatial econometrics: Methods and models*. Dordrecht: Kluwer.

Arenius, P., & De Clerc, D. (2005). A network-based approach on opportunity recognition. *Small Business Economics, 24*(3), 249–256.

Arenius, P., & Minniti, M. (2005). Perceptual variables and nascent entrepreneurship. *Small Business Economics, 24*(3), 233–247.

Armington, C., & Acs, Z. C. (2002). The determinants of regional variation in new firm formation. *Regional Studies, 36*(1), 33–45.

Audretsch, D. B., & Fritsch, M. (1994). The geography of firm births in Germany. *Regional Studies, 28*(4), 359–365.

Audretsch, D. B., & Keilbach, M. (2004). Does entrepreneurship capital matter? *Entrepreneurship Theory and Practice, 28*(5), 419–429.

Audretsch, D. B., & Keilbach, M. (2007). The knowledge spillover theory of entrepreneurship. *Journal of Management Studies, 44*(7), 1242–1254.

Autio, E., & Wennberg, K. (2010). *You think, therefore, I become: Social attitudes and the transition to entrepreneurship*, working paper presented at the DRUID summer conference. Retrieved October 22, 2010, from www2.druid.dk/conferences/viewpaper.php?id=501642&cf=43.

Bergmann, H. (2005). Entrepreneurial attitudes. *Zeitschrift für Wirtschaftsgeographie, 49*(3–4), 185–199.

Bergmann, H., & Sternberg, R. (2007). The changing face of entrepreneurship in Germany. *Small Business Economics, 28*(2–3), 205–221.

Blanchflower, D. G., Oswald, A. J., & Stutzer, A. (2001). Latent entrepreneurship across nations. *European Economic Review, 45*(4–6), 680–691.

Boschma, R. A., & Fritsch, M. (2009). Creative class and regional growth: Empirical evidence from seven European countries. *Economic Geography, 85*(4), 391–423.

Bosma, N., & Schutjens, V. (2011). Understanding regional variation in entrepreneurial activity and entrepreneurial attitude in Europe. *Annals of Regional Science, 47*(3), 711–742.

Bosma, N., van Stel, A., & Suddle, K. (2008). The geography of new firm formation: Evidence from independent start-ups and new subsidiaries in the Netherlands. *International Entrepreneurship and Management Journal, 4*(2), 129–146.

Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models*. Newbury Park, CA: Sage.

Clarke, P. J. (2008). When can group level clustering be ignored? Multilevel models versus single-level models with sparse data. *Journal of Epidemiology and Community Health, 62*(8), 752–758.

Davidsson, P. (2006). Nascent entrepreneurship: Empirical studies and developments'. *Foundations and Trends in Entrepreneurship*, *2*, 1–76.

Davidsson, D. (2012). *Entrepreneurial opportunity and the entrepreneurship nexus: A reconceptualization*. Paper presented at the 2012 Academy of Management Meeting.

Davidsson, P., & Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of Business Venturing, 18*(3), 301–331.

Davidsson, P., & Wiklund, J. (1997). Values, beliefs and regional variations in new firm formation rates. *Journal of Economic Psychology, 18*(2–3), 179–199.

Durbin, J. (1960). Estimation of parameters in time-series regression models. *Journal of the Royal Statistical Society B, 22*(1), 139–153.

Eichhorst, W., & Zimmermann, K.-F. (2007). And then there were four… How many (and which) measures of active labor market policy do we still need? *Applied Economics Quarterly, 53*(3), 243–272.

Etzioni, A. (1987). Entrepreneurship, adaptation and legitimation: A macro-behavioral perspective. *Journal of Economic Behavior and Organisation, 8*(2), 175–189.

Feldman, M. P. (2001). The entrepreneurial event revisited: Firm formation in a regional context. *Industrial and Corporate Change, 10*(4), 861–891.

Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior: The reasoned action approach*. New York: Taylor.

Florida, R. L. (2004). *The rise of the creative class*. Revised paperback edition. New York: Basic Books.

Freytag, A., & Thurik, R. (2007). Entrepreneurship and its determinants in a cross-country setting. *Journal of Evolutionary Economics, 17*(2), 117–131.

Fritsch, M. (2004). Entrepreneurship, entry and performance of new businesses in two growth regimes: East and West Germany. *Journal of Evolutionary Economics, 14*(5), 525–542.

Fritsch, M., & Brixy, U. (2004). The establishment file of the German social insurance statistics. *Journal of Applied Social Science Studies, 124*(1), 183–190.

Fritsch, M., & Falck, O. (2007). New business formation by industry over space and time: A multi-dimensional analysis. *Regional Studies, 41*(2), 157–172.

Fritsch, M., & Mueller, P. (2007). The persistence of regional new business formation activity over time—Assessing the potential of policy promotion programs. *Journal of Evolutionary Economics, 17*(3), 299–315.

Fritsch, M., & Rusakova, A. (2010). Personality traits, self-employment and professions. *Jena Economic Research Papers*, 2010-075.

Fritsch, M., & Stuetzer, M. (2009). The geography of creative people in Germany. *International Journal of Foresight and Innovation Policy, 5*(1–3), 7–23.

Fritsch, M., & Wyrwich, M. (2012). *The long persistence of regional entrepreneurship culture: Germany 1925–2005* (pp. 2012–2036). No: Jena Economic Research Papers.

George, G., & Zahra, S. A. (2002). Culture and its consequences for entrepreneurship. *Entrepreneurship Theory and Practice, 26*(4), 5–8.

Gertler, M. S. (2003). Tacit knowledge and the economic geography of context, or the undefinable tacitness of being (there). *Journal of Economic Geography, 3*(1), 75–99.

Glaeser, E. L. (2005). Review of Richard Florida's The rise of the creative class. *Regional Science and Urban Economics, 35*(5), 593–596.

Grilo, I., & Irigoyen, J. (2006). Entrepreneurship in the EU: To wish and not to be. *Small Business Economics, 26*(4), 305–318.

Guiso, L., Sapienza, P., & Zingales, L. (2008). Long term persistence. *NBER Working Papers,* No. 14278.

Guiso, L., & Schivardi, F. (2005). Learning to be an entrepreneur. *CERP Discussion Paper*, No. 5290.

Hansen, H. K., & Niedomysl, T. (2009). Migration of the creative class: Evidence from Sweden. *Journal of Economic Geography, 9*(2), 191–206.

Hessels, J., van Gelderen, M., & Thurik, R. (2008). Entrepreneurial aspirations, motivations, and their drivers. *Small Business Economics, 31*(3), 323–339.

Hofstede, G. (1980). *Culture's consequences: International differences in work-related values*. Beverly Hills (CA): Sage Publications.

Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations* (2nd ed.). Thousand Oaks, CA: Sage.

Hox, J. J. (2010). *Multilevel analysis* (2nd ed.). New York: Routledge.

Jackson, J. E., & Rodkey, G. R. (1994). The attitudinal climate for entrepreneurial activity. *Public Opinion Quarterly, 58*(3), 358–380.

Jha, S. (2008). Trade, institutions and religious tolerance: Evidence from India. *Stanford University Research Paper*, No. 2004.

Johnson, P., & Parker, S. C. (1996). Spatial variations in the determinants and effects of firm births and deaths. *Regional Studies, 30*(7), 679–688.

Krueger, N. F. (2000). The cognitive infrastructure of opportunity emergence. *Entrepreneurship: Theory & Practice, 24*(3), 5–23.

Krugman, P. (1991). *Geography and trade*. Cambridge, MA: MIT Press.

Lazear, E. P. (2005). Entrepreneurship. *Journal of Labor Economics, 23*(4), 649–680.

Lee, S. Y., Florida, R., & Acs, Z. (2004). Creativity and entrepreneurship: A regional analysis of new firm formation. *Regional Studies, 38*(8), 879–891.

Levie, J. (2007). Immigration, in-migration, ethnicity, and entrepreneurship in the United Kingdom. *Small Business Economics, 28*(2), 143–169.

Ma, R., Huang, Y.-H., & Shenkar, O. (2011). Social networks and opportunity recognition: A cultural comparison between Taiwan and the United States. *Strategic Management Journal, 32*(11), 1183–1205.

Maskell, P., & Malmberg, A. (1999). Localised learning and industrial competitiveness. *Cambridge Journal of Economics, 23*(2), 167–185.

McGranahan, D., & Wojan, T. (2006). Recasting the creative class to examine growth processes in rural and urban communities. *Regional Studies, 41*(2), 197–216.

McMullen, J. S., & Shepherd, D. A. (2006). Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur. *Academy of Management Review, 31*(1), 132–152.

Minniti, M. (2005). Entrepreneurship and network externalities. *Journal of Economic Behavior & Organization, 57*(1), 1–27.

Mueller, P. (2006). Entrepreneurship in the region: Breeding ground for nascent entrepreneurs? *Small Business Economics, 27*(1), 41–58.

Obschonka, M., Silbereisen, R. K., & Wasilewski, J. (2012). Constellations of new demands concerning careers and jobs: Results from a two-country study on social and economic change. *Journal of Vocational Behavior, 80*(1), 211–223.

Ozgen, E., & Baron, R. A. (2007). Social sources of information in opportunity recognition: Effects of mentors, industry networks, and professional forums. *Journal of Business Venturing, 22*(2), 174–192.

Parker, S. C. (2005). Explaining regional variations in entrepreneurship as multiple occupational equilibria. *Journal of Regional Science, 45*(4), 829–850.

Paulhus, D. L., & Trapnell, P. D. (1998). Typological measures of shyness: Additive, interactive and categorical. *Journal of Research in Personality, 32*(2), 183–201.

Qian, H., & Acs, Z. J. (in press). An absorptive capacity theory of knowledge spillover entrepreneurship. *Small Business Economics*. doi:10.1007/s11187-011-9368-x.

Reynolds, P. D., Bosma, N., Autio, E., Hunt, S., De Bono, N., Servais, I., et al. (2005). Global entrepreneurship monitor: Data collection design and implementation 1998–2003. *Small Business Economics, 24*(3), 205–231.

Reynolds, P. D., Miller, B., & Maki, W. R. (1995). Explaining regional variation in business births and deaths: U.S. 1976–1988. *Small Business Economics, 7*(5), 205–231.

Saxenian, A. (1994). *Regional advantage. Culture and competition in Silicon Valley and Route 128*. Cambridge, MA: Harvard University Press.

Selfhout, M., Burk, W., Branje, S., Denissen, J., van Aken, M., & Meeus, W. (2010). Emerging late adolescent friendship networks and big five personality traits: A social network approach. *Journal of Personality, 78*(2), 510–538.

Shane, S. (2000). Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science, 11*(4), 448–469.

Shane, S. (2012). Delivering on the promise of entrepreneurship as a field of research. *Academy of Management Review, 37*(1), 10–20.

Shane, S., Locke, E. A., & Collins, C. J. (2003). Entrepreneurial motivation. *Human Resource Management Review, 13*(2), 257–279.

Shane, S., & Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review, 25*(1), 217–226.

Snijders, T. A. B., & Bosker, R. J. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modelling*. London: Sage Publications.

Spengler, A. (2008). The establishment history panel. *Schmollers Jahrbuch: Zeitschrift für Wirtschafts- und Sozialwissenschaften, 128*(3), 501–508.

Stam, E. (2010). Entrepreneurship, evolution and geography. In R. Boschma & R. Martin (Eds.), *The handbook of evolutionary economic geography* (pp. 139–161). Cheltenham/UK, Northampton/USA: Edward Elgar.

Sternberg, R. J. (2004). Successful intelligence as a basis for entrepreneurship. *Journal of Business Venturing, 19*(2), 189–201.

Sternberg, R. (2009). Regional dimensions of entrepreneurship. *Foundations and Trends in Entrepreneurship, 5*(4), 211–340.

Sternberg, R. (2010). Neither planned nor by chance: How knowledge-intensive clusters emerge. In D. Fornahl, S. Henn, & M.-P. Menzel (Eds.), *Emerging cluster: Theoretical, empirical and political perspectives on the initial stage of cluster evolution* (pp. 295–323). Cheltenham/UK, Northampton/USA: Edward Elgar.

Sternberg, R., & Rocha, H. O. (2007). Why entrepreneurship is a regional event: Theoretical arguments, empirical evidence and policy consequences. In M. P. Rice & T. G. Habbershon (Eds.), *Entrepreneurship: The engine of growth* (pp. 215–238). Westport/CT, London: Praeger.

Stuetzer, M., Obschonka, M., & Schmitt-Rodermund, E. (in press). Balanced skills among nascent entrepreneurs. *Small Business Economics*. doi:10.1007/s11187-012-9423-2.

Tamásy, C. (2006). Determinants of regional entrepreneurship dynamics in contemporary Germany: A conceptual and empirical analysis. *Regional Studies, 40*(4), 364–384.

Vinson, G. A., Conelly, B. S., & Ones, D. D. (2007). Relationships between personality and organization switching: Implications for utility estimates. *International Journal of Selection and Assessment, 15*(1), 118–133.

Wagner, J., & Sternberg, R. (2004). Start-up activities, individual characteristics, and the regional milieu: Lessons for entrepreneurship support policies from German micro data. *Annals of Regional Science, 38*(2), 219–240.