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THE SPATIAL DIMENSION OF ENTREPRENEURSHIP: STYLIZED FACTS FOR THE CASE OF AUSTRIA

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ABSTRACT: *Austria and other European countries are striving to increase the level of entrepreneurial activities to create jobs and income in the aftermath of the Great Recession. The aim of this contribution is to establish stylized empirical facts about regional entrepreneurial activities in Austria. The methodology rests upon a spatial data analysis, the main results of which demonstrate a decline in entrepreneurial activities in the last decade, with a stable pattern of spatial distribution of new ventures and high-growth firms. Overall, our empirical findings point to a number of stylized facts questioning whether entrepreneurship is able to deliver all the proposed miracles policy-makers hope for. In line with the literature in regional economics and entrepreneurship research, our findings suggest persistent interregional differences between the intensity of regional entrepreneurial activities, a higher prevalence of entrepreneurial activity among core regions and a higher concentration of venture capital investments, as compared to innovation and entrepreneurial activities in general.*

Key words: *spatial data analysis, entrepreneurial activities, unemployment, venture capital, spatial concentration, public policy*

JEL classification: L26, R12, E60

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1 INTRODUCTION

Entrepreneurial activities are regarded as an important causal factor of economic growth performance. According to Audretsch (2007), the causal mechanism behind this positive relationship is driven by entrepreneurs who transform investments in knowledge into output growth by facilitating the spillover of new knowledge throughout the economy. Indeed, societies that inhibit entrepreneurs to engage in productive, wealth creating activities may suffer from low levels of innovation and productivity growth (Baumol, 1990; Baumol & Strom, 2007). The agenda of many European countries to speed up entrepreneurial processes relies upon these lines of reasoning. Due to the recent Great Recession, European economies have suffered from a protracted period of sluggish

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economic growth and resulting high unemployment rates. For instance, the Austrian unemployment rate began to rise in the years after the Great Recession and plateaued at 8.3% in 2016, which is the second highest value after the end of World War II. Even though entrepreneurship was already on the agenda of economic policy-makers before the Great Recession, the dire economic circumstances increased its importance as a promising way to foster economic renewal.

Economic policy strategies, such as “Going for Growth” (OECD, 2015) or the “Annual Growth Surveys” (European Commission, 2018), typically include references to the need to increase start-up activities and entrepreneurship in general. Indeed, Austria strives to become the location with the best framework conditions for entrepreneurs in Europe (“Gründerfreundlichstes Land Europas”) (BMWFW, 2015). However, an international comparison reveals a rather low level of entrepreneurial activity in Austria with respect to entry rates of new firms and the share of high-growth enterprises (OECD, 2016; Hölzl, 2010). Below the EU-average venture capital investments and a relatively high degree of risk aversion as a result of deep rooted fears of failure lead to a rather inefficient “national system of entrepreneurship” (European Union, 2018; Kiendl, D., Schmalzer, T., Wenzel, R. & Penz, E. 2017; Acs et al., 2016).

The aim of this contribution is to test and establish stylized empirical facts about regional entrepreneurial activities in Austria. By doing this, we contribute to the emerging literature on the link between entrepreneurship and regional development (Eriksson & Rataj, 2019). The spatial economic research focus is relevant and increasingly popular because entrepreneurial activities are primarily ‘regional events’ (Feldman, 2001). Our research questions address the dynamics, structures and effects of regional entrepreneurship in Austria. Dynamics refer to the temporal development of entrepreneurial activities, structures allude to the spatial dimension of entrepreneurship and effects concern the probable effect of entrepreneurship on unemployment rates.

Therefore, the paper addresses the following questions: (a) What was the impact of the Great Recession on regional entrepreneurship in Austria? (b) Are there systemic differences in entrepreneurship between Austrian regions and what factors may determine such differences? (c) Is it possible to group the Austrian regions into different types of entrepreneurial regimes? (d) Where are venture-capital(VC)-funded start-ups located and what are the potential consequences of these locational choices? (e) What is the statistical relationship between entrepreneurial activity and unemployment? Drawing on theoretical and empirical research in the field of entrepreneurship, the following section deduces five hypotheses from the research questions.

This paper contributes to the current debate on the importance of entrepreneurship in Austria and Europe as it investigates the spatial structures and temporal dynamics of regional entrepreneurship in Austria. Currently, we are not aware of a similar study covering the situation in Austria. It furthermore deepens the understanding of spatial

dimensions of entrepreneurship and raises the issue of national efficiency versus spatial equity in entrepreneurship research. Furthermore, the paper contributes to the current debate by evaluating the optimistic perception of entrepreneurship in the political sphere.

The paper is organized as follows: in the following chapter the existing literature is reviewed, a brief theoretical introduction to this topic provided and the hypotheses presented. In Chapter 3 the methodology and the source of the data are reviewed. Chapters 4 to 7 include a presentation of the analysis of the data and the regional dynamics of entrepreneurship, with Chapter 5 focusing on the spatial structures of entrepreneurship and Chapter 6 introducing VC-firms and the spatial concentration of entrepreneurial activities, while Chapter 7 pays attention to entrepreneurial activities and unemployment dynamics. Finally, conclusions are discussed in Chapter 8.

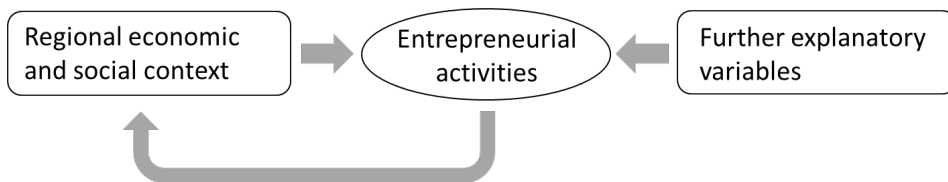
2 LITERATURE REVIEW

The literature defines entrepreneurship as either the creation of new economic activity (e.g. Shane & Venkataraman, 2000), which often results in the creation of new venture (e.g. Schumpeter, 1934; Gartner, 1989), or the pursuit of innovation (Schumpeter, 1934). We follow Plummer and P  r (2010, p. 522) and refer to entrepreneurship as a “competitive process by which perceived profitable opportunities are discovered and exploited by alert individuals and the new organizations that emerge, grow, prosper, or fail as a result.” Schumpeter (1934) introduced the idea that changes in technology leading to business opportunities deployed by entrepreneurs contribute to economic development through a process of creative destruction. Hence, new ventures as well as growth processes of firms are considered important outcomes of entrepreneurial activities. In the continuation, these two characteristics of entrepreneurship are analysed by considering the statistics on firm formation and high-growth firms. Both the creation of new ventures and the quality of their growth are consistently seen by academics but also by politicians and decision-makers as essential drivers of regional economic development (Scarpetta, 2003). Birch (1981) explored and demonstrated the link between entrepreneurship and economic growth from an empirical point of view through a longitudinal study and found that small and medium-sized enterprises (SMEs) were the main driver of job creation within the United States (US). Birch’s initiation was followed by not only academic but also institutional studies, which confirmed his findings and in addition extended and developed this field of research. However, as entrepreneurial activities are to some degree dependant on the status of the overall economy, recessions might have a negative effect on the creation of new businesses and the survival and development of the existing ventures (Fairlie, 2013). What is more, recessions limit the availability of resources, including access to (venture) capital and local demand (Latham & Braun, 2011). Thus, from the discussion above, we derive the following hypothesis:

- Hypothesis 1: The Great Recession had a negative effect on entrepreneurship in Austria (see section 4).

The relationship between entrepreneurial activities and the region as a subnational spatial entity is illustrated in Figure 1. Focusing on the regional level can be justified by two reasons. Firstly, most entrepreneurial processes operate predominantly on a regional level (Feldman, 2001). Explanations for this regional concentration of entrepreneurial activities can be found in reduced transaction costs, such as lower transportation and communication costs (Leamer, 2007), but also reduced search costs when using local networks as spatial proximity supporting relationship formation, information exchange and knowledge diffusion (Krugman, 1991a; Porter, 2000b). Secondly, countries are characterized by substantial variations in regional economic structures which lead to a vast variation of entrepreneurial contexts (Sternberg, 2009). Figure 1 proposes a circular relationship between the entrepreneurial process on the individual level and the region. The idea of circular processes in space is one of the basic propositions of regional economics and is also recognized in the entrepreneurship literature (McCann, 2013; Eriksson & Rataj, 2019). A region may be characterized by variables such as economic structure and human capital endowment, the presence of financial institutions such as banks or venture capital funds, and social norms or regional public policies. Fink et al. (2012, p. 16) review entrepreneurship policies in the Austrian regions and conclude that “(...) location matters when setting up a company in Austria, because between the (nine Austrian) states entrepreneurship policy measures differ not only in focus and intensity but also regarding the instruments employed and the phases of the start-up process in which support can be received.”

Figure 1: *The nexus between regional economic context and entrepreneurship*



Source: authors' own draft

Recent research has summarized and conceptualized the variables describing the regional context by the notion of an “entrepreneurial ecosystem” (Spiegel & Harrison, 2018; Mack & Mayer, 2016). On the one hand, new ventures may trigger a process of creative destruction within the region and thereby change the regional economic and social context. On the other hand, new ventures may generate spillovers, increase entrepreneurial knowledge and initiate a reinforcing process of circular and cumulative causation via positive feedback loops that reshapes the regional economic context (Frisch, 2013). In addition, other variables, such as the business cycle or trade policy, will also influence entrepreneurial activities in a certain region. The ideas of a circular process of spatial development and the importance of the regional economic context are elaborated for example in Porter (2000a) and Krugman (1991). Plummer and Peèr (2010) discuss the different theoretical approaches in detail and

conclude with a proposition to merge entrepreneurship theories and regional economics into an integrated framework that conceptualizes entrepreneurship as an inherent spatial process. Fritsch and Wyrwich (2014) show that these spatial processes display a high degree of persistence. Based on our research questions, the discussion of theory, and public policy of regional entrepreneurship, we develop the following hypotheses:

- Hypothesis 2: There are persistent differences between the intensity of regional entrepreneurial activities in Austria (see section 5).
- Hypothesis 3: Entrepreneurship is more prevalent among core regions with high levels of economic development, thereby exacerbating spatial disparities between core and peripheral regions within a country (see section 5).
- Hypothesis 4: Regional entrepreneurial activities lower regional unemployment rates (see section 7).

In the field of regional entrepreneurial development, venture capitalists have gained some interest as they expand their influence in determining who receives funding for their entrepreneurial venture. From a regional point of view, venture capital funding might consequently affect the economic performance of regions (Sorenson & Stuart, 2001). Specialised resources of regional entrepreneurial ecosystems—such as a venture capital provider—supporting entrepreneurial activities tend to be regionally concentrated (Autio et al., 2018). In addition, a high spatial concentration of the venture capital provider might increase the effective coordination amongst investors which could impact their incentives. This geographic dimension of venture capitalists can be supported by a high concentration of high-growth potential start-ups (Adler et al., 2019). In conclusion, we derive the following hypothesis:

- Hypothesis 5: Venture capital investments display higher spatial concentrations than innovation and entrepreneurial activities in general (see section 6).

Hence, hypothesis 1 is about short-term developments of regional entrepreneurship in Austria. Hypotheses 2, 3 and 5 address the question of spatial structures of regional entrepreneurship in Austria, whereas hypothesis 4 is about possible effects of regional entrepreneurship on regional unemployment rates. On the whole, the hypotheses are connected by the overall theme of this paper, namely the relationship between entrepreneurship and regional development.

The aim of this paper is to test the above presented hypotheses on stylized facts of entrepreneurship in Austria. The contribution of this paper is twofold, namely on the one hand, we aim to enrich the information for political decision-makers by investigating the empirical regularities and to inform the public debate on the role and relevance of

entrepreneurship in economic policy. On the other hand, we intend to add further empirical evidence to the literature on entrepreneurship and regional development. As pointed out recently by Eriksson and Rataj (2019), the missing puzzle to explain the relationship between entrepreneurship and regional development is the geographic dimension. This paper strives to contribute to this ongoing strand of empirical and theoretical research.

3 METHODOLOGY AND DATA

The applied methodology rests upon descriptive and inferential statistics of secondary and primary data. In particular, the methods of the bivariate regression, correlation analysis, spatial statistics, concentration analysis and hierarchical cluster analysis respectively are applied. Regarding the spatial analysis, patterns of spatial autocorrelation are analysed by calculating Moran's I. The Herfindahl Index is used to estimate the concentration of economic variables at the level of Austrian NUTS2 regions. Since different methods are applied throughout the paper, we describe the methods in detail at the beginning of each empirical chapter.

Variables that are utilized include entrepreneurship variables, regional unemployment rates, regional gross domestic product (GDP) and sectoral growth rates of the total factor productivity (TFP). In this paper we use four entrepreneurship variables, namely (i) birth rates of new ventures, (ii) death rates of firms, (iii) share of high growth firms, and (iv) the number of start-ups with funding from a venture capital fund. All variables are available for either the NUTS 2 or the NUTS 3 level. Regarding the time dimension, the data is from 2004 or 2008 to 2012 or 2014.

Secondary data are from (i) Statistics Austria, (ii) Eurostat and (iii) EU-KLEMS. The variables birth rates of new ventures, death rates of firms and the share of high growth firms are taken from Statistik Austria. We use the data sets "Unternehmensdemografie (bis 2014)" (enterprise demography) and "Schnellwachsende Unternehmen (bis 2014)" (high-growth enterprises). The statistics on birth and death of firms (enterprise churn) comprises only firms whose revenue is greater than €10,000 or firms that have at least one employee. The birth rate (death rate) is defined as the number of new firms (exiting firms) as a percentage of the existing firms (Eurostat 2012). A high-growth enterprise (growth by 10% or more) is defined as an enterprise with an average annualised growth in the number of employees greater than 10% per year over a three-year period ($t - 3$ to t) and having at least 10 employees in the beginning of the growth ($t - 3$). The share of growth firms refers to the number of high-growth firms divided by all firms with more than ten employees. The TFP-numbers are from EU-KLEMS; Koszerek, Havik, McMorrow, Röger and Schönborn (2007) describe the growth accounting framework behind the estimation of the sectoral and national TFP growth rates used in the EU-KLEMS framework.

For the fourth entrepreneurship variable, i.e. the number of start-ups with funding from a venture capital fund, we collected primary data based on the identification of the major VC funds operating in Austria. The data represent the stock of investments in the year 2015. Even though this procedure does not consider all VC-funded firms, based on the literature and anecdotal evidence it is reasonable to assume that the locational pattern of the non-included VC-funded firms is similar to the pattern observed in our sample (Peneder & Schwarz 2008).

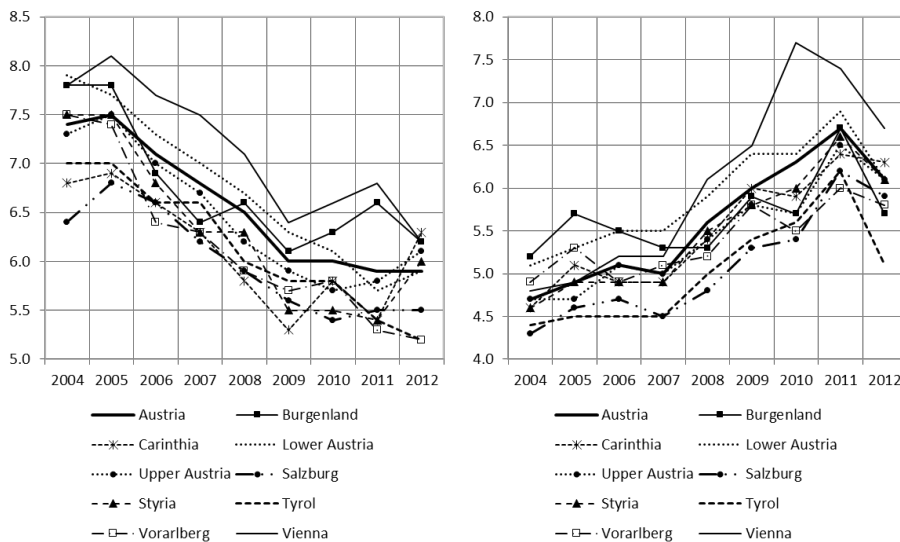
4 REGIONAL DYNAMICS OF ENTREPRENEURSHIP

Entrepreneurship is affected by and affects the business cycle. The aim of this section is to analyse the development of birth and death rates of businesses before and during the financial crisis of 2008-2009, also referred to as the “Great Recession”. A comparison with other countries as well as efficiency issues pertaining to regional enterprise dynamics during the Great Recession are discussed based on the data at the level of Austrian NUTS2 regions. The aim is to test hypothesis 1: The “Great Recession” had a negative effect on entrepreneurship in Austria.

Figure 2 shows the entry and death rates at the NUTS2 level, i.e. for the nine Austrian federal states (“Bundesländer”) and for Austria. Regarding birth rates (left panel), a clear downward trend can be observed which already began before the “Great Recession”. The share of new ventures declined from about 7.5% in 2005 to somewhat below 6% in 2012. In absolute numbers, new ventures in Austria declined from about 28,500 at the peak in 2005 to around 24,000 in 2012, which amounts to approximately 4500 fewer new firms per year.

This negative trend captures all new ventures without considering the differences of the new ventures in terms of their innovation performance. According to the Austrian innovation strategy “Becoming an Innovation Leader”, the number of new knowledge-intensive firms is supposed to increase by 3% per year (Republic of Austria, 2011). However, the data on the new knowledge-intensive firms in services and manufacturing reveal an actual decline between 2010 and 2014 (RFTE, 2017). As a result, the decline rate in new firm formation also holds true for high-innovative ventures. This pattern of an overall reduction in entrepreneurial dynamism is of course not unique for Austria, as the time series data for Germany (Metzger, 2016) and the United States (Hathaway & Litan, 2014) reveal quite a similar negative trend.

Figure 2: Enterprise birth rates (left panel) and death rates (right panel), 2004-2012



Source: Statistik Austria (2018)

Death rates of firms are displayed in the right panel of Figure 2. In addition to the declining birth rates, death rates increase over time. In 2011, a change of this trend seems to have taken place, showing a drop of death rates in all regions. Yet, the overall death rates at the national level surged from 4.7% in 2004 to 6.1% in 2012. This may indicate an increasingly challenging business environment or changing opportunity costs of entrepreneurship due to labour market developments making dependent employment more attractive. Because of these contrarian trends of birth and death rates, the enterprise churn rates have remained constant at about 12% while the net business population growth has declined.

These results may of course not be in line with the vision of policy-makers as outlined in entrepreneurship policy strategy papers (BMWF, 2015). From a welfare economics point of view, however, the results ask for a more elaborate interpretation. Popular views on entrepreneurship assume that higher levels of entrepreneurial activities translate into welfare gains. A more nuanced view would take into account also the business models of the firms which enter or exit the market. For instance, high entry and exit rates of firms with an outdated, non-innovative business model may be considered a waste of resources and more common in less developed economies (Hölzl, 2010; Fritsch, 2008). Hence, the declining enterprise churn in Austria may point to a declining welfare due to a lower level of entrepreneurial experimentation. But if the decline is the result of a reduction of entrepreneurial activities of firms with an outdated, non-innovative business model, the welfare implications may be quite different. Since the decline of new firm formation also

applies to knowledge-intensive firms (see above), the pessimistic view, i.e. a loss in social and economic welfare, seems to offer the more appropriate interpretation.

In addition to this general trend, a persistent pattern of regional disparities in entrepreneurial activities exists between the nine Austrian regions. While Vienna and Lower Austria constantly display a higher birth rate than the national total, Salzburg and Carinthia perform below the national level. The lines are parallel, which suggests that the differences remain stable even under changing conditions during the business cycle. The range between the region with the highest and the lowest entry rate is about 1.5 percentage points. Similar observations hold true for death rates apart from Vienna, which experienced a much more pronounced rise in its death rate after 2007 compared to the other regions. Further analysis reveals that regions with above average birth rates also have above average death rates, suggesting different spatial regimes of enterprise churn. The correlation coefficient between the two rates at the regional level for the years 2004-2012 is 0.68 on average.

The onset of the Great Recession in 2008 and its deepening in the following years because of the Euro crisis may be discerned in the development of birth rates, switching from a declining trend with the minimum in 2009 to stagnation or an increase in the next years, at least in some regions. This may be interpreted as a recession-push effect which leads to higher rates of new firm formation because of lower chances to find dependent employment. Firm death rates, on the other hand, started to rise shortly before the economic crisis and began to decline in 2010 and 2011. At any rate, the increase of the death rate between 2008 and 2011 can be interpreted as a result of a more difficult economic environment characterized by low demand and high uncertainty.

The welfare implications of the dynamics during the crisis depend upon whether or not a “cleansing effect” occurs (Dias & Robalo Marques 2018). This effect works through firms that were not as productive as their peers before a recession and become even more unproductive during a downturn or even exit the market. Of course, this phenomenon is discussed differently within the theoretical literature and empirical studies. The theoretical literature suggests a pro-cyclical behaviour of firm entry and job creation, i.e. more firms enter during booms than in recessions and create a higher number of jobs while less-productive firms vanish from markets during difficult economic times (Moscarini & Postel-Vinay, 2012). This process resembles what Schumpeter described as “creative destruction” (Schumpeter, 1939), i.e. sluggish, incumbent firms have to exit the market when a new wave of technological innovations driven by innovators changes the competitive environment. Yet, empirical studies, such as by Lee & Mukoyama (2012) and Gomis & Khatiwada (2016), cannot support the existence of such a cleansing effect. In fact, Lee & Mukoyama (2012) point out that firms that are founded during booms are 25 per cent smaller and 10-20 per cent less productive than counterparts that enter during recessions. Given the focus of the paper, a similar, methodologically advanced exercise for the case of Austria is out of scope. However, a simple descriptive analysis based on aggregated data at the sectional level of the ÖNACE-classification (17 industries) reveals

no statistically significant relationship between the efficiency of an industry (measured by its TFP-growth between 1996 and 2008, data from EU-KLEMS) and its difference between the average enterprise birth and death rates (2009-2012). The two industries with the highest efficiency (financial activities and manufacturing) experienced a difference between birth and death rates of the size of -1.7 and -0.4 percentage points, with -0.4 being the median difference over all industries. On the whole, however, the pattern remains inconclusive at least for this level of analysis, and the question whether or not a “cleansing effect” occurred during the “Great Recession” in Austria remains open.

Our conclusions regarding hypothesis 1, i.e. the Great Recession had a negative effect on entrepreneurship in Austria, are that the empirical analysis provides mixed evidence. There is some indication of a rise in enterprise death rates between 2008 and 2011 whereas the birth rates had already followed a negative trend since 2005, i.e. before the crisis set in. In addition, there is also no unambiguous answer to whether or not there was a “cleansing effect” at work during the “Great Recession” in Austria.

5 SPATIAL STRUCTURES OF ENTREPRENEURSHIP

In this section, hypotheses 2 and 3 are tested, positing a spatial persistency and a core-periphery structure of entrepreneurial activities.

Core and periphery

Economic geography presumes that there are persistent differences in economic activity between core regions and peripheral regions (Krugman, 1991). The former are characterized by high productivity levels and net gains in terms of factor mobility, while the latter suffer from stagnation and lower standards of living. The question arises whether it is possible to establish such a core and periphery pattern also for entrepreneurial activities.

We consider the spatial disparities of entry rates and share of high growth firms at the level of the 35 Austrian NUTS3 regions. Both indicators are from Statistik Austria (see above). Therefore, the average value for the five years 2008-2012 for each region is calculated and the regions ordered according to their average value. The five regions at the top and the bottom of this distribution are identified and their performance during the years 2008-2012 is compared with the median value for each year. In the final step, we investigate whether top regions fall below the median and whether bottom regions perform above the median in any given year. This method enables us to analyse whether regional disparities are persistent. In addition, we calculate correlation coefficients and test their significance to substantiate the results from the descriptive statistics and consider all regions together. A strong positive and significant correlation suggests the persistence of regions with permanently high and low levels of entrepreneurship respectively. The main limitation of this methodology stems from the short period of observations, which may be considered being too short for making judgements about persistent spatial disparities.

Table 1 displays the entry rates for the 5 regions with the highest and the lowest entry rates respectively. Whereas the region of Nordburgenland had on average 7% of new firms relative to the existing firms, the number for Lienz was only 4.8%. Again, the spatial disparities are characterized by a high degree of persistence. Regions with a high entry rate constantly perform above the median of all 35 regions and vice versa. There is not a single year in which a leading or a laggard region performed below or above the median. This stable pattern is also reflected in a high positive temporal auto-correlation between the years from 2008 to 2012. The coefficients range between 0.6 and 0.8 and are highly significant at the 1% level if a two-sided hypothesis test is applied. The development of the entry rates over time suggests that there is no clear sign of convergence between the two groups of regions in Table 1. Indeed, the standard deviation for the 35 regions with respect to the entry rate increases from 0.62 (2008) to 0.65 (2012). Fritsch & Wyrwich (2014) corroborate the finding of persistent spatial differences in entrepreneurship activities for Germany for the period 1925-2005. They find that persistency tends to exist for about eight years despite substantial changes in the institutional context. Their explanation rests upon the existence of cultures of regional entrepreneurship exhibiting characteristics of inertia.

Table 1: *The 5 regions with highest and lowest entry rates, percentages 2008-2012*

NUTS 3 Region	2008	2009	2010	2011	2012	Average	Difference in percentage points, 2012-2008
AT112 Nordburgenland	7.5	6.7	6.5	7.4	6.7	7.0	-0.8
AT130 Wien (Vienna)	7.1	6.4	6.6	6.8	6.2	6.6	-0.9
AT126 Wiener Umland/ Nordteil	7.3	6.6	6.5	6.1	6.6	6.6	-0.7
AT122 Niederoesterreich-Sued	7.3	6.9	6.9	5.7	5.9	6.5	-1.4
AT127 Wiener Umland/Suedteil	6.8	6.5	6.2	5.9	6.4	6.4	-0.4
<i>Median</i>	6.2	5.8	5.5	5.6	5.7	5.8	-0.5
AT333 Osttirol	5.8	5.8	5.0	4.7	4.4	5.1	-1.4
AT212 Oberkaernten	4.9	4.4	5.3	5.3	5.2	5.0	0.3
AT334 Tiroler Oberland	5.6	5.0	5.1	4.7	4.7	5.0	-0.9
AT341 Bludenz-Bregenzer Wald	4.9	4.9	5.3	4.6	4.9	4.9	0
AT222 Lienz	5.6	4.4	4.4	4.4	5.0	4.8	-0.6

Source: Own empirical research, Statistik Austria.

The regional disparities of high growth firm activities are somewhat less persistent. Table 2 shows the 5 regions with the highest and the lowest shares of fast-growing firms from 2008 to 2013. While it is still true that there are substantial and stable differences between the two regional groups, laggard regions may occasionally perform above the median value and the leading regions below the median value, which can perhaps be ascribed to the

regression-to-the-mean effects. The respective cells are coloured in grey. The differences in the last column show that the share of high-growth firms is also characterized by a negative trend. The correlation coefficient between the years ranges from about 0.4 and 0.6, hence being lower than in the case of entry rates. As a result, only three out of four correlation coefficients are statistically significant at the 1% level, with the exception in the correlation between 2010 and 2012 which shows a p-value of 0.17.

Table 2: *The 5 regions with the highest and lowest share of fast growing enterprises, percentages 2008-2013*

UTS 3 Region	2008	2009	2010	2012	2013	Average	Difference in percentage points, 2013-2008
AT13 Wien (Vienna)	10.6	7.7	6.9	8.1	9	8.46	-1.6
AT221 Graz	9	6.5	7	8.4	8.7	7.92	-0.3
AT112 Nordburgenland	8.3	6.3	7	8.1	8.3	7.6	0
AT123 Sankt Poelten	8.5	6.4	6.7	8.3	7.8	7.54	-0.7
AT225 West- und Suedsteiermark	9.2	8.6	6.4	6	6.9	7.42	-2.3
<i>Median</i>	8.65	5.75	5.3	6.4	6.85	6.59	-1.8
AT125 Weinviertel	8.7	4.4	4.1	2.5	5.8	5.1	-2.9
AT226 Westliche Obersteiermark	7.7	2.8	2.8	6.1	5.5	5.0	-2.2
AT335 Tiroler Unterland	6.2	3.9	4.1	4.3	5.6	4.8	-0.6
AT111 Mittelburgenland	4.9	2.0	3.4	7.1	3.8	4.2	-1.1
AT331 Ausserfern	6.7	3.1	3.0	1.8	5.1	3.9	-1.6

Source: Own empirical research, Statistik Austria, data for 2011 is not available.

Spatial autocorrelation

The spatial structure of entrepreneurship is not characterized only by significant regional differences but also by the fact that regions with high and low levels of entrepreneurial activities are not randomly distributed (Plummer & Pe'er, 2010). There is a high probability that regions with a high entrepreneurial performance have neighbouring regions with similar characteristics, perhaps indicating the existence of regional spillovers.

To measure the pattern of the spatial co-location of regions with similar attributes, we calculated the metric of Moran's I, which is basically a correlation coefficient for spatial data. The spatial structure must therefore be modelled in the form of a spatial weight matrix. The analysis is based on the basic concept binary weights, with 0 indicating the absence of a common border between regions and 1 the presence of it. This choice for the

spatial weight matrix can be justified by the spatial geometry of NUTS 3 regions around regional capital cities (they are circumscribed by up to five regions) and the regional nature of entrepreneurial activity, which makes it rather unlikely that spatial spillovers are relevant over very large distances. Moran's I is calculated as follows:

$$I = \frac{n \sum_{i=1}^n \sum_{j=1}^n w_{ij} (x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^n \sum_{j=1}^n w_{ij} \sum_{i=1}^n (x_i - \bar{x})^2},$$

where indices i and j refer to regions i and j , w_{ij} denotes the element in the spatial weight matrix that represents the relationship between region i and j , while x_i and x_j are the values of the variable of interest in region i and j respectively. A positive (negative) value of I indicates that neighbouring regions display a similar (dissimilar) level of entrepreneurial activity. A significance test of I can be based upon the normality or the randomisation assumption. Following the recommendation from literature, the randomisation assumption is chosen (Burt, Barber & Rigby 2009). In this case, the deviations between the observed spatial pattern and a simulated random pattern are used to construct a standard, normally distributed test-statistic. The R-Package `spdep` from Roger Bivand et al. (2019) is used for the calculation of Moran's I . The method is limited by the usage of a simple contiguity spatial weight matrix and a global correlation coefficient. Alternatively, distance based metrics may reveal additional insights while local indicators of spatial association (LISA) could provide a more detailed picture of spatial autocorrelation.

The analysis of spatial autocorrelation is undertaken for the firm entry and exit rates and the share of high growth firms. The calculation of the Moran's I for the entry and exit rates of firms for the NUTS3 regions gives a positive and significant spatial correlation for both variables. In the case of entry rates Moran's I equals 0.27 (p-value: 0.01), and for exit rates Moran's I equals 0.31 (p-value 0.003). In contrast to the entry and exit rate, the share of high-growth firms shows a weak negative and non-significant Moran's I (Moran's I : -0.05, p-value: 0.847). This result fits with the discussion in the previous paragraph, where it is argued that the regional disparities of high-growth firm activities are somewhat less persistent than the exit rates. An explanation for the differences in spatial disparities between the entry and exit rates on the one hand and high-growth firms on the other hand may be provided by the more stochastic nature of firm growth episodes. In a current survey of the literature, Moreno and Coad (2015) point out that gazelles are represented in all sectors and enterprise size classes. Furthermore, growth episodes are—as the name says—episodes with almost no inter-temporal spillovers from one period to another. Both factors arguably contribute to the disconnection between the spatial incidence of high growth firms and the economic structure, an important variable that describes the regional and economic context.

Hypothesis 2 states that there are persistent differences between the intensity of regional entrepreneurial activities in Austria. This hypothesis is clearly supported by the data and in line with research results for other countries (Eriksson & Rataj, 2019; Fritsch & Wyrwich, 2014). Interestingly, birth and death rates show a higher degree of spatial persistence than the share of high growth enterprises. Considering the high importance of “Gazelles” in public policy discussions, this result warrants further explanation in future studies.

Clusters of entrepreneurship

The analysis of spatial disparities and spatial correlation suggests that there are stable and significant differences between regions in terms of their entrepreneurial performance. To gain a better understanding of the differences between regions, we performed a hierarchical cluster analysis utilizing the Euclidean distance to measure the dissimilarities between observations and the average linkage method as a clustering method (Maechler, 2018). Hence, we put forward the question on whether it is possible to group the Austrian regions into different types of entrepreneurial regimes based on different indicators of entrepreneurship.

We apply the 35 NUTS 3 regions and the two entrepreneurial variables “entry rate” and “share of high growth firms”. To control for yearly fluctuations, the average of the variables between 2008 and 2012/13 is used for the cluster analysis. The agglomerative coefficient is at 0.81 suggesting that the data are well suited for a cluster analysis. The main results of the analysis are displayed in Table 3. While there is always a subjective element in deciding how many clusters to extract, it turned out that 5 clusters are a practical solution.

Table 3: *Regions with similar entrepreneurial dynamics*

Cluster	Entry rates (average)	Share high-growth firms (average)	NUTS 3 Region	Weighted average regional productivity (in Euros)
1	6.80	8.05	AT112 Nordburgenland, AT130 Wien	71,361
2	6.50	6.17	AT122 Niederoesterreich-Sued, AT126 Wiener Umland/Nordteil, AT127 Wiener Umland/Suedteil	65,820
3	5.88	7.12	AT113 Suedburgenland, AT123 Sankt Poelten, AT221 Graz, AT211 Klagenfurt-Villach, AT223 oestliche Obersteiermark, AT224 Oststeiermark, AT225 West- und Suedsteiermark, AT311 Innviertel, AT312 Linz-Wels, AT314 Steyr-Kirchdorf, AT315 Traunviertel, AT323 Salzburg und Umgebung, AT332 Innsbruck, AT342 Rheintal-Bodenseegebiet,	62,025
4	5.62	4.60	AT111 Mittelburgenland, AT125 Weinviertel, AT226 Westliche Obersteiermark, AT331 Außerfern, AT335 Tiroler Unterland	60,866
5	5.24	6.05	AT121 Mostviertel-Eisenwurzen, AT124 Waldviertel, AT212 Oberkaernten, AT213 Unterkaernten, AT222 Liezen, AT313 Muehlviertel, AT321 Lungau, AT322 Pinzgau-Pongau, AT333 Osttirol, AT334 Tiroler Oberland, AT341 Bludenz-Bregenzer Wald	56,174

Source: Own empirical research, Statistik Austria. Notes: Regional productivity is measured as output per person employed in Euros, average 2011-2013, weights: share of persons employed in 2013

The big picture of the cluster analysis reveals substantial differences between the core and peripheral regions, namely higher levels of regional entrepreneurial activities are inversely related to the median regional productivity level. Whereas the former show high levels of entrepreneurial activity, the latter have low levels of entry rates and low shares of high growth firms. In that sense, entrepreneurship may not be a force that induces catching-up processes of lagging regions. The high intensity of entrepreneurial activities in Vienna (and Nordburgenland) testifies to the importance of agglomeration economies in entrepreneurship.

The clusters in Table 3 show clear differences and are relatively simple to interpret. Cluster 1 consists of the capital city Vienna and one neighbouring region. The second cluster is made up of the suburban regions which surround Vienna. Essentially, clusters 1 and 2 can be thought of as the economic functional region of Vienna as opposed to the administrative region. Austria's core industrial regions and their respective six regional capital cities are grouped together in cluster 3, which may point to the importance of the regional economic

structure in understanding the differences in the regional entrepreneurship performance. Further, the fourth cluster represents a group of regions that cannot be easily interpreted, as there are no important economic centres in these regions found and the economic base is dominated by service activities. Finally, cluster 5 represents regions that can be considered as peripheral regions, where low levels of entrepreneurial activity and an inferior productivity level are indicative of this appraisal.

Hypothesis 3 stipulates a higher prevalence of entrepreneurial activities within the core regions with high levels of economic development. The cluster analysis reveals substantial differences between the core and peripheral regions in Austria, with higher levels of regional entrepreneurial activities being inversely related to the median regional productivity level. Hence, hypothesis 3, a finding which is in line with the empirical literature, is confirmed (Bosma & Schutjens, 2011; Isaksen, 2015).

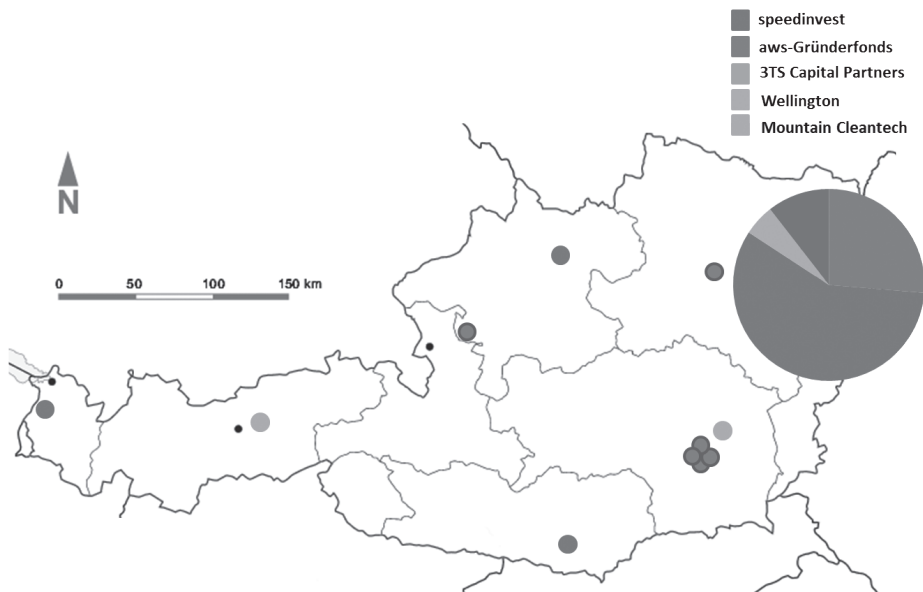
6 VC-FIRMS AND THE SPATIAL CONCENTRATION OF ENTREPRENEURIAL ACTIVITIES

In the continuation, we define start-ups as young (i.e. up to five years old) companies which are primarily focused on developing an innovative technology or service with a scalable business model, capable of and focused on rapid growth. Such firms are not founded in a vacuum or out-of-thin-air but are created and then co-evolve within a diverse system with dense interactions with suppliers of physical goods as well as ideas, customers and financiers. The two main pillars of an entrepreneurial eco-system are first and foremost the start-ups themselves which generate the ideas and try to develop these into scalable business models potentially leading to increases in value added, employment and profits. The second pillar is formed by financiers, i.e. individual business angels and institutionalised venture capital firms, which are ready to take the risk and inject venture capital into the start-up often long before any marketable product (and hence turnover) is available. These two pillars form the scissor blades of the regional VC market where VC firms provide the supply of risk capital and start-ups demand financing. However, the role of financiers goes well beyond mere capital allocation. Usually, they provide necessary business know-how and social capital (i.e. access to networks etc.) for the start-ups in their portfolio and offer strategic guidance and monitoring. Obviously, spatial proximity is beneficial for performing these tasks, nevertheless, externalities play a prominent role as well. It is easier to start a new business if there are plenty of other entrepreneurs around from whom one can learn. VC markets and start-ups, often co-evolve, and localised phenomena with their interdependency might initialise cumulative, self-reinforcing processes, in other words, VC goes to regions where new start-ups are created and new start-ups are created where VC is located (Lerner, 2010). This co-evolving pattern for Austria was analysed by the empirical approach of first identifying the major VC funds (and a selection of business angels) operating in Austria. Essentially, we made a selection of all the VC-funds that participated in the aws Venture Capital Initiative or a similar public policy program to support VC investments in Austria, including the aws Gründerfonds (public venture

capital).⁴ The collected data represent the stock of investments in the year 2015. In the end, the portfolio firms (start-ups) of the selected VC funds were identified and their locational pattern recorded. Overall, even though this procedure does not consider all VC-funded firms, it is—based on the literature and anecdotal evidence—reasonable to assume that the locational pattern of the non-included VC-funded firms is similar to the one observed in our sample, in which in total a sample of 33 VC-funded firms was realized.

Figure 3 shows the spatial distribution of the VC-funded firms in Austria. The overall result is a striking degree of spatial concentration of VC-funded firms mainly in Vienna, while only two other cities manage to host more than one VC-funded firm, namely Graz (4 firms) and Linz (2 firms). In addition, only 18% of the 33 analysed start-ups are located outside Vienna or a regional capital.

Figure 3: *Locations of VC-funded start-ups (stock 2015)*



Source: Own empirical research

The issue of the spatial concentration of entrepreneurial activity is further explored in Table 4 for the nine Austrian NUTS 2 regions. The columns show the shares of the regions in entrepreneurial variables in comparison with the shares in GDP. In addition, the

⁴ <https://www.aws.at/foerderungen/aws-venture-capital-initiative/> [15.11.2017]

Herfindahl-Index (HI) is given the last row. The Herfindahl-Index is a measure of concentration and defined for the variable x by

$$HI = \sum_{i=1}^N \left(\frac{x_i}{\sum_{i=1}^N x_i} \right)^2.$$

The higher the value of HI, the higher the degree of concentration. In the case of a uniformly distributed variable over the N statistical units, the HI takes on the minimum value of $1/N$. If the entire sum of the variable is concentrated in one statistical unit, the HI assumes the maximum value of 1.

Comparing the shares of GDP and new ventures and the share of high-growth firms indicates a strong relationship between them, which is a result that is also corroborated by the almost identical number of the HI for the three variables. Hence, at least at the NUTS 2 level, the entrepreneurial activities in the form of new ventures and the high growth firms are not more concentrated in space than GDP. However, things are different when considering VC-funded firms, as Vienna hosts about 55% of them whereas no VC-firm is located in Burgenland or Salzburg. Consequently, the corresponding HI is more than double the size compared to the share of all new ventures.

Table 4: *Share, concentration and spatial disparity GDP, new ventures, high growth firms, venture capital (VC) financed firms and gross expenditures on R&D (GERD)*

NUTS 2 Region	Share GDP (2015)	Share new ventures (2015)	Share high growth firms (2015)	Share VC firms (2016)	Share GERD (2015)
Burgenland	2.3	4.2	2.5	0.0	0.8
Carinthia	5.5	7.1	4.5	3.0	5.6
Lower Austria	15.7	18.8	13.4	6.1	8.9
Salzburg	7.3	6.2	8.1	0.0	3.7
Styria	12.8	14.3	14.0	15.2	21.3
Tyrol	9.1	7.8	9.6	6.1	9.2
Upper Austria	17.1	14.0	16.2	12.1	17.6
Vienna	25.5	23.9	27.3	54.5	30.2
Vorarlberg	4.7	3.6	4.4	3.0	2.9
<i>Herfindahl-Index</i>	<i>0.154</i>	<i>0.151</i>	<i>0.159</i>	<i>0.344</i>	<i>0.189</i>

Source: Own empirical research, Statistik Austria

If it is the case that the praised benefits of start-ups accrue first and foremost to the region which they are located in, for example because of localized positive externalities, then the hope that public policy initiatives fostering start-ups will “lift all boats” is misplaced. Lerner (2010) points out that the overall dynamic of VC investments may induce a vicious circle in regions with few venture capital related activities. Thereby, publicly supported VC investments may increase the overall level of entrepreneurial activities at the high end of the quality distribution of new ventures. Concomitantly, however, this may also lead to rising interregional disparities in the Austrian landscape of entrepreneurship. There may be no simple way to counteract this tendency by redirecting publicly supported VC investments into non-central regions, because the efficiency gains associated with VC investments are assumed to emanate only in an open, creative and high-skilled environment of cities.

Hypothesis 5 postulates a higher concentration of venture capital investments as compared to the spatial concentrations of innovation and entrepreneurial activities in general. Indeed, our data support the hypothesis and the analysis shows that start-ups with venture capital investment are basically concentrated in Vienna and the second biggest city of Austria, namely Graz. These results are essentially in line with the existing empirical literature (Mason & Harrison, 2002; Lerner, 2010) and suggest that venture capital might contribute to increasing spatial disparities between the central and peripheral regions in Austria.

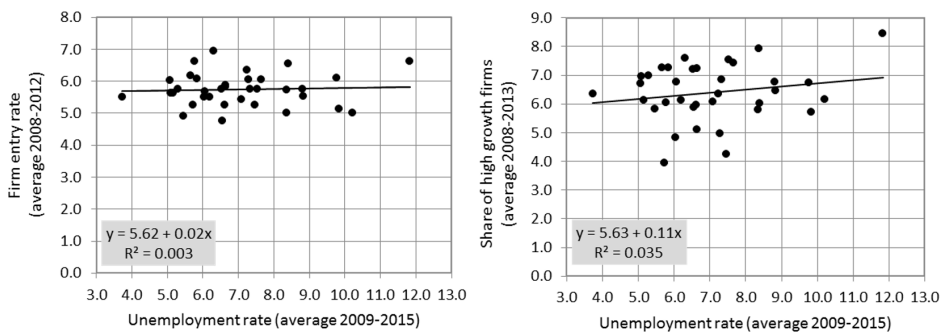
7 ENTREPRENEURIAL ACTIVITIES AND UNEMPLOYMENT DYNAMICS

The effect of self-employment on the labour market has been controversially discussed within the academic literature, as the relationship between entrepreneurship and unemployment seems to be a complex puzzle. One stream argues that a higher rate of unemployment might stimulate the creation of new ventures (the “refugee” effect), while another stream counters that higher rates of self-employment indicate an increased economic activity within a certain region (the “entrepreneurial” effect). Both arguments have different implications for the job market (Thurik et al., 2008). In general, the public discourse usually associates new ventures with employment growth, yet, this conjecture may be overoptimistic about the actual employment effects of new firms (Fritsch, 2008). One explanation for this biased perception of entrepreneurship may have to do with the distinction between partial equilibrium effects versus general equilibrium effects. Of course, a new firm increases *ceteris paribus* and on average total employment. But this usually goes together with a loss of employment in incumbent firms because of the competition from the new venture. If new ventures are more productive than established companies, then the total direct employment effect becomes negative. The positive effects of new ventures rest predominantly upon indirect, supply side effects that ultimately lead to an improved competitiveness of the regional business sector. This reasoning points to the fact that the innovativeness of entrepreneurial activities is a crucial variable in determining the employment impact of new businesses.

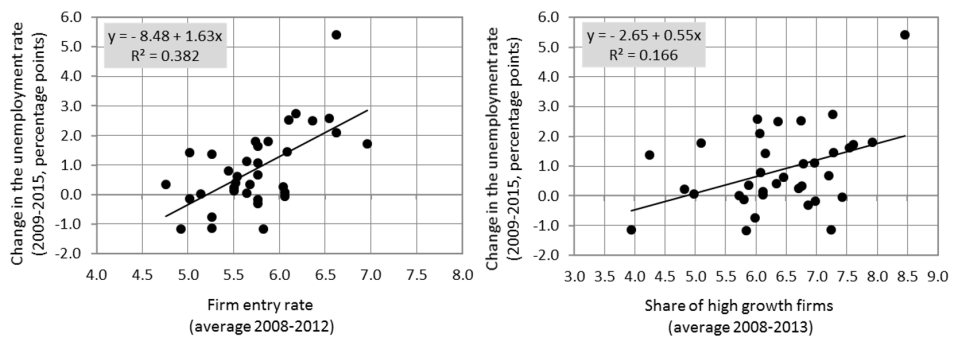
Analysing the causal employment effects of entrepreneurship requires the use of advanced quantitative techniques and panel data. In the present study, we follow a humbler approach and provide only bivariate descriptive evidence. Figure 4 shows the relationship between the level of unemployment rate (average 2009-2015) and the level of entrepreneurial activity (also measured as average over several years to account for idiosyncratic effects). The overall picture is that there is no clear relationship between entrepreneurship activities and unemployment rate, as both slope coefficients are not significant at the 5% level. It could theoretically be expected that higher unemployment leads to a higher level of new firm formation as unemployed workers are “pushed” into precarious forms of self-employment. Yet, this is—at least at the regional level—not the case.

A different question is whether entrepreneurial activities may influence a change in unemployment rate. Figure 5 shows a change in the unemployment rate between 2009 and 2015 as a dependent variable on the y-axis. However, the relationship is quite the opposite of what policy-makers hope for, namely a higher level of entrepreneurial activity is associated with a higher increase in the unemployment rate. The slope coefficient is significant at the 1% level for both entrepreneurship indicators, however, the explanatory power seems to be higher for the firm entry rate ($R^2=0.38$) than for the share of high growth firms ($R^2=0.17$). For the firm entry rate, the numerical relationship is as follows: With 95% confidence, the unemployment rate increases between +0.9 and +2.4 percentage points when the firm entry rate increases by one percentage point. Of course, this result may not be interpreted in a causal way even though the initial effect of new ventures on employment might be initially negative (see above). The outlier in the three scatter plots in Figure 5 is Vienna, which again shows the peculiar role of the capital city in shaping the entrepreneurial dynamics in the Austrian economy.

Figure 4: *The relationship between the level of unemployment rate and entrepreneurship*



Source: Statistik Austria, Eurostat, AMS

Figure 5: *The relationship between the change of unemployment rate and entrepreneurship*

Source: Statistik Austria, Eurostat

In this section, the question whether regional entrepreneurial activities lower regional unemployment rates (hypothesis 4) is tested. The results based on the changes observed in the unemployment rate as a dependent variable lead us to reject our claim since they suggest that higher levels of entrepreneurial activity are associated with a higher unemployment rate, in other words, entrepreneurial regions experienced a higher increase in unemployment than less entrepreneurial regions. Interestingly, the results hold for both new firm formation and the share of high-growth firms. Of course, these results are based on a simple bivariate analysis, while more sophisticated research designs have identified a negative impact of entrepreneurship on unemployment rates (Thurik et al., 2008). On the other hand, Fritsch and Schroeter (2011) investigate regional differences in the effect of new firms on the employment growth in West Germany and finds a negative influence of a high share of small business employment on the employment effect of new firms. This effect may be behind our finding of entrepreneurial regions experiencing a more pronounced increase in unemployment. However, our results should be interpreted with a grain of salt in terms of an interpretation of a causal relationship between entrepreneurial activities and unemployment because there may be a number of confounding variables at work which may impact upon both unemployment and entrepreneurship. At least our findings suggest that there is no simple direct relationship between new ventures and lower unemployment rates. The regional economic context and other variables are of relevance as well and may even be more important than entrepreneurial activities.

8 CONCLUSIONS

This paper contributes to the emerging literature on the relationship between entrepreneurship and regional development by testing five hypotheses about spatial patterns of entrepreneurship in Austria. Concerning hypothesis 1, claiming that the Great Recession had a negative effect on entrepreneurship in Austria, the empirical analysis provides mixed evidence. Hypothesis 2 states that there are persistent differences between the intensity of regional entrepreneurial activities. This hypothesis is supported by the data and in line with the international empirical evidence in entrepreneurship research. Also hypothesis 3, according to which core regions display higher levels of entrepreneurial activity, is corroborated by our statistical analysis. Hypothesis 4 tests the politically important question of whether regional entrepreneurial activities lower regional unemployment rates. Based on a bivariate data analysis, our findings suggest that there is no simple direct relationship between new ventures and lower unemployment rates. The regional economic context and other variables are also of relevance and may even be more important than entrepreneurial activities. Finally, hypothesis 5 postulates a higher concentration of venture capital investments as compared to innovation and entrepreneurial activities in general. We find supporting evidence for hypothesis 5, a result which is in line with the literature on regional economics and entrepreneurship research.

Regarding limitations, our research can be criticized on the following grounds: (a) short time series data, (b) focus on a bivariate data analysis instead of a multivariate data analysis, and (c) concentration on a small number of indicators of entrepreneurship.

The results suggest a number of research implications. Firstly, the link between unemployment and entrepreneurship should receive more attention in entrepreneurship research. Society and public policy consider the employment effects of new ventures as very important but showing them empirically is a rather challenging exercise. The following two questions might be of particular interest from a spatial perspective: What is the employment effect of entrepreneurship in different types of regions? What type of entrepreneurship has the highest employment impact in regions? In addition, our research suggests some differences between high growth firms and business demography variables, such as firm birth and death rates. As high growth firms display a more volatile pattern and less spatial persistency, the question to investigate this issue further is: What factors may explain this outcome? Finally, innovation-based development strategies in Europe aim to increase the creation of new start-ups. Our findings show that this results in a highly polarized pattern of spatial development and the question arises how to compensate for the losing regions in this increasingly unequal competition for investment and jobs.

Taken together, the empirical findings point to a few stylized facts that may be considered bad news for policy-makers. These findings suggest that policy-makers are probably too enthusiastic about the economic miracles entrepreneurship may deliver. Firstly, on the whole, entrepreneurial activities are declining without making significant contributions

to solving unemployment problems, and secondly, their spatial impact might increase the unevenness of spatial economic development.

New policy strategies should set realistic goals and consider potential negative side effects of entrepreneurship. Additionally, our analysis has revealed a potential policy failure in the Austrian entrepreneurship policies (Fink et al., 2012). Entrepreneurs receive the most support in the later stages of the start-up process, providing successful projects with an additional boost. Yet, such an approach fails to enable risk-taking at early stages, which is perhaps not only the most difficult phase of the life-cycle of a new venture but also more prone than others to market failures (Mazzucato, 2013).

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