

Discussion Paper No. 09-060

**Skill Composition and  
Regional Entrepreneurship:  
A Comparative Study  
Between Germany and Portugal**

Joana Mendonça and Christoph Grimpe

**ZEW**

Zentrum für Europäische  
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Economic Research

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## **Non-technical summary**

The availability of skilled labor has frequently been characterized as a key determinant of entrepreneurial activity in a region. Little is known, however, whether the composition of the regional skill base will have an effect on new firm creation. In regional economics, particularly the Marshallian specialization and the Jacobs diversity argument have attracted attention. While the former states that economics growth will benefit most if industrial activity is clustered enabling knowledge spillovers between similar firms, the latter argues that diversity provides more opportunities for cross-fertilization and the realization of complementarity effects. We transfer these arguments to the context of regional entrepreneurial activity and argue that the skill composition in a region, along with the generally available human capital, will shape firm entry in different groups of knowledge-based industries.

Moreover, we argue that a key role is played by the institutional infrastructures for entrepreneurship which presumably moderate the relationship between the skill composition and regional entrepreneurial activity. We define these infrastructures as the result a region's legal, institutional and social factors conducive to entrepreneurship. As these should predominantly vary at the national level, we present a comparative study of this relationship for Germany and Portugal. Both countries, though member states of the European Union, are fairly different from each other in terms of economic capacity and geography. Hence, the institutional infrastructures for entrepreneurship may vary considerably between the two countries. Using harmonized datasets for both countries thus allows shedding light on the institutional infrastructures of both countries which are supposed to moderate the relationship between regional skill composition and entrepreneurial activity.

Our results are based on regional data at the NUTS III level for both countries from 2000 to 2004. They indicate that, besides the importance of human capital available in a region, the composition of skills matters considerably. While it turns out that in Portugal firm entries are positively affected by a high concentration of skills, it is the opposite result for Germany which apparently benefits from higher diversity. Hence, we suggest that both concentration and diversity may be important but contingent on the institutional infrastructures for entrepreneurship. Regional development policies directed at fostering entrepreneurial activity should acknowledge that both specialization and diversity of the regional skill base may benefit entrepreneurship instead of promoting, all too generally, the clustering of certain industries. Our research provides an indication that diversity may pay off most in a highly developed country context while specialization seems to be key in less developed countries. The reason for this may be that the effectiveness of knowledge spillovers is contingent to the institutional infrastructures, and that the effectiveness may either be spurred through specialization or diversity. In addition, these results indicate that policy measures fostering new firm formation, especially in knowledge intensive sectors, should be considered on a more local level, considering the specificities of each region.

## Das Wichtigste in Kürze

Das Vorhandensein von qualifizierten Arbeitskräften wird oft als ausschlaggebender Faktor für Unternehmensgründungen in einer Region bezeichnet. Es ist jedoch wenig darüber bekannt, ob die Zusammensetzung der regionalen Wissensbasis Auswirkungen auf neue Unternehmensgründungen hat. In der Regionalökonomik haben besonders die Spezialisierungstheorie nach Marshall und die Diversifikationstheorie nach Jacobs für Aufmerksamkeit gesorgt. Während die erste Theorie nahe legt, dass Wirtschaftswachstum vor allem von der Bündelung von Wirtschaftszweigen in Clustern gefördert wird, da dadurch der Wissenstransfer zwischen ähnlichen Unternehmen ermöglicht wird, argumentiert die zweite Theorie, dass Diversifikation bessere Möglichkeiten zum gegenseitigen Wissensaustausch bietet und Komplementaritätseffekte erzielt werden können. Wir beziehen diese Argumente auf den Kontext regionaler unternehmerischer Aktivitäten und vertreten die Auffassung, dass die Zusammensetzung des Fachwissens in einer Region zusammen mit der generellen Verfügbarkeit von Humankapital den Firmeneintritt in verschiedene Gruppen von wissensbasierten Branchen beeinflusst.

Des Weiteren legen wir dar, dass institutionelle Infrastrukturen für Unternehmensgründungen eine Schlüsselrolle spielen, da sie vermutlich die Beziehung zwischen unternehmerischen Aktivitäten und der Struktur der Wissensbasis beeinflussen. Wir beschreiben diese Infrastrukturen als das Ergebnis der gesetzlichen, institutionellen und sozialen Faktoren in einer Region, die förderlich für Unternehmensgründungen sind. Da sich diese auf nationaler Ebene besonders stark unterscheiden sollten, präsentieren wir eine Vergleichsstudie dieser Beziehung für Deutschland und Portugal. Obwohl beide Länder Mitgliedsstaaten der Europäischen Union sind, unterscheiden sie sich deutlich hinsichtlich einer Reihe gesamtwirtschaftlicher Kennzahlen. Daher werden vermutlich auch die institutionellen Infrastrukturen für Unternehmensgründungen in diesen beiden Ländern stark variieren. Mithilfe von harmonisierten Datensätzen für beide Länder können somit Erkenntnisse über die institutionellen Infrastrukturen in beiden Ländern gewonnen werden, die vermutlich die Beziehung zwischen der regionalen Zusammensetzung der Wissensbasis und unternehmerischen Aktivitäten beeinflussen.

Unsere Ergebnisse beziehen sich auf regionale Daten auf der NUTS III Ebene für beide Länder von 2000 bis 2004. Sie zeigen, dass neben der Verfügbarkeit von Humankapital in einer Region auch die Zusammensetzung des Fachwissens ausschlaggebend ist. Es stellt sich heraus, dass sich in Portugal eine hohe Konzentration von Fähigkeiten besonders positiv auf Unternehmensgründungen auswirkt, während in Deutschland das Gegenteil der Fall ist, da dort eine höhere Diversifikation von Vorteil ist. Wir stellen somit fest, dass sowohl Konzentration als auch Diversifikation in Abhängigkeit von den institutionellen Infrastrukturen wichtig sein kann. Regionale Entwicklungspolitik, die auf die Förderung von Unternehmensgründungen abzielt, sollte daher berücksichtigen, dass sich sowohl die Konzentration als auch die Diversifikation der regionalen Wissensbasis positiv auf unternehmerische Aktivitäten auswirken kann, anstatt sich zu stark auf die Bildung bestimmter Branchencluster zu konzentrieren.

# **Skill Composition and Regional Entrepreneurship: A Comparative Study between Germany and Portugal**

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## **Abstract**

The question whether agglomeration externalities arise either from specialization or diversification of economic activity has since long been a major topic in the analysis of factors determining economic growth. In this paper we analyze whether a more specialized or a more diverse skill composition of labor in regions affects the level of new firm entries in general as well as in technology- and knowledge-intensive subsectors. We compare Germany and Portugal which exhibit, though EU member states, different institutional infrastructures for entrepreneurship. Based on a harmonized dataset, our results indicate that the skill composition has different effects on firm entry in the two countries. More specifically, for Portugal the specialization of skills has a positive effect on the level on new firm entry in all sectors. In contrast to this, our results for Germany reveal exactly the opposite effect. These results suggest that both specialization and diversity theories hold, and that the effect thus may depend on other more local and regional factors.

**Keywords:** Entrepreneurship, skill composition, regional analysis, comparative study

**JEL-Classification:** J24, L26, O57, R11

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# 1 Introduction

It has become a part of conventional wisdom that most developed market economies are nowadays based on knowledge (Griliches, 1979). The endogenous growth model developed by Romer (1990, 1994) states that knowledge production increases with research input, and in particular with input in terms of human capital. Moreover, knowledge is likely to spill over, which refers to the fact that organizations like universities, research centres and firms benefit from each others' R&D activities on the same topic (Arrow, 1962). Several studies, however, have shown that the opportunities for knowledge spillovers depend on proximity, with increasing distance being detrimental to the extent that spillovers can be realized (e.g., Jaffe, 1989; Feldman, 1994; Audretsch and Feldman, 1996). The reason for this is 'stickyness' of knowledge (von Hippel, 1994), which means that knowledge is highly contextual and requires interaction and frequent contact to spill over (Feldman and Audretsch, 1999). In this respect, a key role is played by entrepreneurship because it serves as a conduit to knowledge spillovers (Audretsch and Keilbach, 2008). As a result, industries tend to concentrate in space, and this effect is particularly strong in industries that are more dependent on new knowledge.

In fact, the question whether agglomeration externalities arise either from specialization or diversification of economic activity has since long been a major topic in the analysis of factors determining economic growth (van der Panne, 2004). Marshall (1920) defined three factors that can lead to the geographic concentration of industries: labor market pooling, availability of intermediate inputs into production processes, and knowledge spillovers between firms. These factors have also been identified as stimulating the entry of new firms into those regions that already have a strong industrial base. The Marshallian specialization argument defends that regions specialized towards a particular industry tend to be more innovative in that particular industry, as it allows for knowledge to spill over between similar firms. Location within a cluster of related industries increases firm's competitive advantage, resulting in higher growth than in similar firms not located in a cluster (Wood et al., 2004). In contrast to this, the Jacobs diversification thesis argues that knowledge spills over between different industries, causing diversified economies to be more innovative (van der Panne, 2004). Gains from variety at the firm level (economies of scope) and the urban level (Jacobs externalities) provide the central feedback mechanism in economic development generating strong path dependencies in the spatial concentration of industries and the specialization of cities.

Most empirical studies have suggested that firms are more productive and innovative when clustered within a location (Faberman, 2005). Some of these studies have looked at firm growth. For instance, Glaeser et al. (1992) explored how positive externalities arising from both regional industry concentration and diversity may contribute to firm employment and growth. Other studies have linked agglomeration externalities with higher innovative performance of the firm (Baptista and Swann, 1998; Feldman and Audretsch, 1999). Most studies on industrial location consider the existence of agglomeration externalities as a key determinant of the geographical concentration of economic activities. Externalities contribute

to firm competitiveness and innovative performance through mechanisms that involve both concentration and diversity of industries (Glaeser et al., 1992), as well as the local presence of specialized workers, intellectual capital, customers and suppliers, and other sources of information concerning market conditions and technological developments (Audretsch, 2003). Although using different theoretical tools, both urban economists and economic geographers have long advocated that urban agglomerations grow, amongst other things, because they allow people to interact and learn from each other (Jacobs, 1969; Henderson, 1974; Florida, 1995; Gertler, 1995; Simmie and Lever, 2002). The frequency of such interaction is enhanced by geographical proximity.

Little, however, is known about the importance of skill composition. Particularly in knowledge-based industries, the availability of skilled labor has been characterized as central to economic growth (Lucas, 1988; Boschma and Lambooy, 1999). Applying the Marshallian specialization and the Jacobian diversity argument to the labor market therefore leads to the question whether entrepreneurial activity in a region will benefit more from either a specialized or a diversified skill base. Hence in this paper, we argue that the skill composition in a region, along with the generally available human capital, will shape firm entry in different groups of knowledge-based industries. We present a comparative study of this relationship for Germany and Portugal. Both countries, though member states of the European Union, are fairly different from each other in terms of economic capacity and geography. Hence, the institutional infrastructures for entrepreneurship may vary considerably between the two countries. Using harmonized datasets for both countries thus allows shedding light on the institutional infrastructures of both countries which are supposed to moderate the relationship between skill composition and regional entrepreneurial activity.

The remainder of this paper is organized as follows. The next section outlines our theoretical background, putting emphasis on the relationship between the availability of skilled labor and regional entrepreneurial activity. Moreover, differences between the two countries on which our study is based are highlighted. Section 3 presents our data and methodology. The results are presented and discussed in Section 4. Section 5 concludes with implications and an outline of potential future research avenues.

## **2 Theoretical background**

While the composition of the industrial base has been found to be an important predictor of growth differences between regions (e.g., Feldman and Audretsch, 1999), little is known about the importance of the composition of skilled labor in a region. In this respect, the skill base may act as an important factor to explain growth through entrepreneurial activities (Lucas, 1988; Boschma and Lambooy, 1999). Skilled labor is one element of the human capital available in a region. First of all, human capital can be assumed to directly affect entrepreneurial activity as skilled people will presumably have higher chances to recognize entrepreneurial opportunities and commercialize new ideas and inventions (Shane, 2000). Therefore, regions with more human capital will tend to be more innovative and

entrepreneurial, thereby growing faster. Second, the composition of human capital in terms of professions or disciplines that can be found in a region's businesses and organizations should matter. The reason for this is knowledge spillovers that may either stem from the specialization or diversity of human capital.

In fact, as knowledge becomes more important as a factor of production, knowledge spillovers also gain significance as a source of economic growth. Variations across countries and regions in entrepreneurial activity can be a source of different efficiencies in knowledge spillovers, and eventually in economic growth (Acs and Varga, 2005). There are several channels through which knowledge can spread to firms or individuals: it can be codified in books and other publications; it can be conveyed through public presentations of various types, such as seminars and conferences; it can be gained through reverse engineering and other purposive search processes. Knowledge may also be embedded in people, for example graduates who take a job at a firm or start their own business. The extent to which knowledge flows through these different channels depends upon the recipient's skills and abilities, the nature of the knowledge itself (for example, level of complexity and level of tacitness), and other factors that bring academic and industry sector scientists together (Geroski, 1995). Jaffe et al. (1993) posit that the ability to receive spillovers may be a reason for the concentration of activity. And the ability to receive spillovers is partially dependent on the human capital which is able to absorb it and use it, meaning that differences in human capital in regions will generate differences in the ability to absorb spillovers, and therefore in the concentration of activity. Cohen and Levinthal (1989, 1990) have referred to this as the 'absorptive capacity' of individuals or organizations.

Existing literature provides several arguments for why either specialization or diversity of the regional skill base should spur knowledge spillovers and therefore be more conducive to entrepreneurial activity, innovation, and economic growth. Following the Marshallian specialization argument, regions specialized towards a particular industry may be more innovative in that industry because knowledge may spill over easily between similar firms which can be assumed to have higher absorptive capacities in that particular industry. Hence, location within a cluster of related industries may increase a firm's innovative performance and create entrepreneurial opportunities, resulting in higher growth than in case of similar firms not located in a cluster of firms in related industries (e.g., Wood et al., 2004; Faberman, 2005).

In contrast to this cluster logic, several studies highlight the importance of diversity of regional human capital. Andersson et al. (2005) relate patent activity to measures of localization and urbanization, to the industrial composition and size distribution of firms, and to the regional distribution of human capital. They find that patents are responsive to the spatial distribution of workers at different levels of education and the distribution of private and public R&D facilities. They also find that the level of innovation is positively influenced by the diversity of the employment base, providing support to the specialization hypothesis. Accordingly, Okamuro and Kobayashi (2005) find that human resource factors are important determinants of regional start-up. The local levels of knowledge creation and acceptance of new ideas will depend on the local human capital, not just the levels of education, but also on the diversity of skills.



Lee et al. (2004) argue that entrepreneurial activity requires not only a productive and supportive business climate along with an educated population, but also a climate where creativity, diversity, and innovation are encouraged and valued. The authors argue that more diverse regions tend to have lower entry barriers which make it easier for human capital with various backgrounds to enter the region and propel entrepreneurial activity. Research also suggests that the composition of economic activity has an impact on the regional level of innovative activity. Feldman and Audretsch (1999) find evidence that specialization of economic activity does not promote innovative output. Rather, they find evidence that diversity across complementary economic activities sharing a common science base is more conducive to innovation than is specialization. In addition, their results indicate that the degree of local competition for new ideas within a city is more conducive to innovative activity. As a result, entrepreneurial activity benefits from urbanization economies, i.e. the co-location of complementary, yet diverse, skills.

Hence, there are indications that both specialization and diversity of the skill base may be favorable for entrepreneurial activity in a region. In this relationship, however, a key moderating role is presumably played by the institutional infrastructures for entrepreneurship. Audretsch and Keilbach (2007, 2008) focus on entrepreneurship capital that they define as the result of a region's legal, institutional and social factors conducive to entrepreneurship. They find that knowledge-based entrepreneurship capital is driven by local levels of knowledge creation and the acceptance of new ideas, indicating that local knowledge flows play an important role. According to these authors, entrepreneurship capital is a phenomenon that is driven by local institutions and culture, and that is therefore locally bounded. We argue that the institutional infrastructures for entrepreneurship will particularly vary at the national level and to a much lesser degree at the regional level. Intra-national infrastructures feature a common legal and institutional framework, together with a rather homogeneous culture. Differences in institutional infrastructures for entrepreneurship and their effect on the relationship between specialization, diversity and entrepreneurial activity may therefore be properly addressed by means of a comparative study between two countries.

For this purpose, we run the cross-country comparison for Portugal and Germany. Both countries are member states of the European Union but at the same time fairly different in terms of economic and social characteristics and, hence, institutional infrastructures for entrepreneurship. Table 1 shows some economic characteristics of both countries, which reveal these differences.

**Table 1: Economic characteristics of Germany and Portugal**

	<b>Germany</b>	<b>Portugal</b>
GDP 1998 (billion EUR)	1952	106
GDP 2000 (billion EUR)	2063	122
Income pc (EUR)	29,115	14,161
Gini coefficient	28.3	38.5
Human development index	0.93	0.90
Unemployment rate 1998 (%)	9.1	5.1
Unemployment rate 2000 (%)	7.5	4.0
Inflation rate 1998 (%)	0.6	2.2
Inflation rate 2000 (%)	1.4	2.8
Population 2007 (million)	82.6	10.4
Population in urbanized regions (%)	88.1	60.9
Area (square km)	357,022	91,982
Population per square km	231	114

Source: Eurostat; Human Development Report 2007

First of all, Germany is much larger in size, both in terms of area and population. Its GDP is more than 20 times as high as in Portugal. The average income per capita is roughly the double. While Germany has a higher unemployment rate than Portugal, inflation is higher in Portugal. Germany has a higher population density, and a higher share of the population lives in urbanized regions. Moreover, Germany is a technology-intensive country while Portugal's economy is less dependent on knowledge and technology (Faria and Sofka, 2007). Due to these differences, their regions' growth patterns may differ, and the effect of specialization and diversity may not be the same in the two countries. Hence, in our analysis we will evaluate whether the differences between the two countries will have an impact on the hypothesized relationship between the skill composition in a region and regional entrepreneurial activity.

### **3 Empirical method**

#### **3.1 Data**

We use two harmonized datasets for Portugal and Germany based on the NUTS III regional classification level in the period from 2000 to 2004. Portuguese data is drawn from the *Quadros de Pessoal* dataset, gathered annually by the Portuguese Ministry of Social Security on the basis of a mandatory survey. This is a longitudinal matched employer-employee database which includes extensive information on all private firms, establishments and workers in the Portuguese economy for the period from 1986 to 2007. New firm entry in all sectors as well as in two knowledge-intensive subsectors, i.e. high- and medium-high-technology as well as knowledge-intensive services, was identified and assigned to the

Portuguese NUTS III regions. Additional data concerning the NUTS III regions were gathered from the National Institute of Statistics (INE).

The German data is based on information from the German statistical office (Destatis) and Eurostat. Information on firm entry stems from the Mannheim Foundation Panel, a database which is compiled annually by the Centre for European Economic Research (ZEW) in Mannheim, Germany. Data are based on information from the Creditreform agency and cover virtually the population of firms in Germany. Data on the regional skill base are taken from the IAB Linked Employer-Employee Panel (LIAB) which combines data from the IAB Establishment Panel and the Employment Statistics Register. The IAB Establishment Panel is based on an annual survey of establishments in Western Germany and has been administered since 1993 by the research institute of the Federal Employment Services in Nuremberg, Germany. Establishments in Eastern Germany entered the panel in 1996. The database is therefore a representative sample of German establishments employing at least one employee who pays social security contributions.

### 3.2 Measures

Both datasets have been harmonized to contain comparative variables that can be used for our study. As dependent variables we use the total number of new firms entering in a particular region as well as the number of new firms entering in two subsectors, i.e. high- and medium-high-technology as well as knowledge-intensive services, which follows an OECD classification of industries (OECD, 2002).<sup>1</sup>

We measure the skill base of a region by two measures.<sup>2</sup> The first is a standard measure for the general human capital available in a region (Audretsch and Feldman, 2004; Andersson et al., 2005). It is defined as the share of the employees with college education over the total number of employees contributing to social security. The second measure accounts for the specialization of skills in a region, based on a simple concentration measure. This measure is based on the distribution of employees amongst a group of occupations in science and engineering, i.e. in physics and chemistry; mathematics and computer sciences; engineering

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<sup>1</sup> We follow Fritsch and Falck (2007) who argue that the start-up rate, i.e. number of firm entries per 1000 employees, is significantly shaped by changes in employment in the region, and thus use the count of new firm entries.

<sup>2</sup> For Germany, using data from the LIAB involves the restriction that some NUTS III regions, particularly in Eastern Germany, have been aggregated to microcensus regions in order to fulfil the minimum size requirements of 100,000 inhabitants. As a result, the 439 NUTS III regions are combined to 343 microcensus regions. Our analyses are based on the NUTS III regions, and therefore the two measures for the skill base had to be disaggregated in order to be merged with the other regional data. As both measures are shares, we decided to use the same value for every NUTS III region combined into a microcensus region, thus slightly reducing the variance for these measures.

and architecture; life sciences; health sciences; social sciences; artists and writers.<sup>3</sup> The specialization measure is calculated as follows:

$$s_i = \frac{\max(x_{ij})}{\sum_1^j x_j},$$

where  $i$  is the region and  $j$  the occupation. Hence, for every region the largest group of employees as a share of the total workforce is taken to depict regional skill specialization. A high value of  $s_i$  thus shows high concentration while a low value would hint at high diversity.

Moreover, we introduce control variables for other regional factors which are likely to affect the number of new firms in each region. The logarithm of total population is used as a measure of regional demand size, which should represent an attraction for start-ups. It is also a measure for the size of the regional labor pool which refers to the supply of potential entrepreneurs. We expect to find more new firm entries in more populated regions. Annual growth of the GDP is introduced in the estimation to account for the level of economic development and dynamics of the regions. Regions with higher GDP growth should also be more likely to have a higher number of new firms entering. In addition, we introduce unemployment rates which depict the role of unemployed persons in new firm formation activity (Fritsch and Falk, 2007). We expect that higher unemployment rates may positively affect entry of firms in all sectors, but will negatively affect entry in more knowledge and technology intensive sectors, which are more likely to depend on other sources of human capital. In addition, we introduce year dummies to account for time-specific influences, such as differences in the effects of business cycles across regions. Finally, we add dummies for the NUTS I or II regions which are motivated in the subsequent section.

### 3.3 Model

Since our dependent variable is a count variable and because of overdispersion we use negative binomial regression models to explain the number of new firms entering in each region. We conduct separate analyses for Portugal and Germany and data are pooled for the years 2000 to 2004. Due to endogeneity concerns, the dependent variable, i.e. the number of firm entries in different sectors, is taken from each following year, i.e. from 2001 to 2005. As a consequence, there may be autocorrelation over time because regions with a certain number of new firm entries are likely to have correspondingly high numbers in other years. Our analysis thus accounts for these cluster-correlated data in order to avoid an underestimation of the true variance by applying the Huber/White correction. Moreover, there may be spatial autocorrelation which we address by estimating a spatial cross-regressive model that accounts

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<sup>3</sup> These professions refer to the International Standard Classification of Occupations (ISCO-88) of the International Labour Organisation (ILO), Occupations in Science and Engineering Codes 211-214, 221-223, 244, 245.

for the effects of neighboring regions by including dummy variables for the 16 Federal States (Laender) in case of Germany and for the 5 major provinces (NUTS II) in case of Portugal (Fritsch and Falck, 2007).

Finally, there is an ample discussion in the literature as to whether the choice for a certain regional level of aggregation as the unit of analysis will have an effect on the results. This issue becomes even more pronounced when different countries are compared to each other as the NUTS classification system does not always refer to comparable regions at the same level. Hence, for Germany we follow Audretsch and Keilbach (2007, 2008) who base their analysis on the NUTS III level, referring to 439 German districts and therefore providing a very fine-grained regional breakdown. Most studies in labor economics for Germany, however, focus on labor market regions as the unit of analysis. We thus complement the analysis by a robustness check using the classification proposed by Eckey et al. (2007) which encompasses 150 regions based on commuting flows. In order to employ comparably sized regions, our analysis uses the 28 NUTS III regions for mainland Portugal.

## **4 Results**

### **4.1 Regional distribution of entrepreneurial activity and descriptive statistics**

We start off with a look at the regional distribution of new firm entries in Germany and Portugal as a sum for the period from 2001 to 2005. Figure 1 displays the distribution of new firms in the 28 Portuguese NUTS III regions. The map reveals a high concentration of firms along the coastline, with greater incidence in the north of the country. The two NUTS III regions containing the main cities of Lisbon and Oporto distinguish themselves from the remaining regions. This evidence has been shown previously by Baptista and Preto (2007) who observe that only the large metropolitan regions of Lisbon and Oporto (NUTS III) can be considered as highly agglomerated and are the ones that display higher entry rates. In fact, their work suggests that the NUTS III regions comprehending Lisbon and Oporto can be called ‘gazelle regions’, whereas the remaining ‘elephant regions’ display below average levels of agglomeration and business dynamics. Nevertheless, observing the map in Figure 1 allows for the distinction of other groups. From these, the regions with highest levels of new firm formation are in the North, Ave and Tâmega, Setúbal south from Lisbon, and the Algarve, known for its touristic development. The group right after contains two regions of Cávado and Oeste, which display a higher number of firms, associated with the strong cluster of glass and moulding industries which had developed over the years in those areas. The remaining regions consist of the inland regions which display a relatively low level of economic activity.

**Figure 1: Regional Distribution of new firms in NUTS III regions in Portugal**

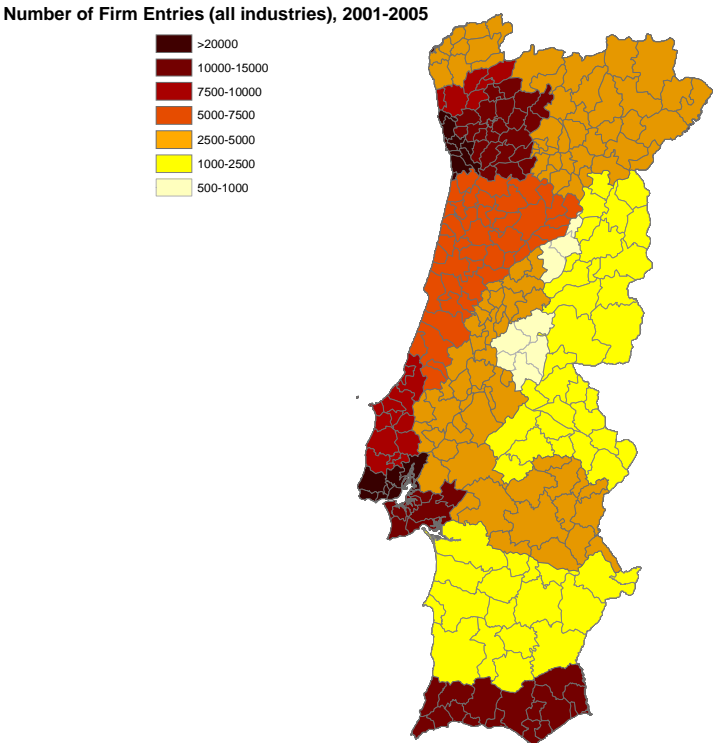


Figure 2 presents the regional distribution of new firm entries across Germany. It can be clearly seen that East Germany, with the exception of Berlin and very few other cities, still suffers from de-industrialization and migration into the West, following the liquidation of most of the dilapidated industrial base. Other dynamic regions include the Stuttgart, Hamburg, Hannover and Ruhr area. In the south of the country, the region of Munich stands out from the remaining regions. Generally speaking, the pattern of new firm entries seems to reflect the levels of regional economic power.

**Figure 2: Regional Distribution of new firms in NUTS III regions in Germany**

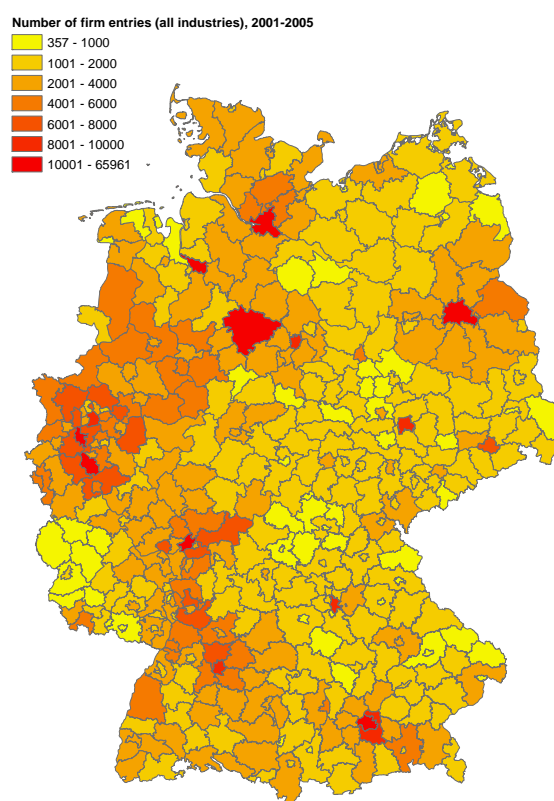


Table 2 and Table 3 show the descriptive statistics for the variables under study in both countries. We observe that firm entry in absolute numbers in Germany is much higher than in Portugal. In both countries only a small fraction of entries is in high- and medium-high-technology sectors. Significantly more entries can be observed in knowledge-intensive services. Regarding the human capital, 6 percent of the workforce in Portugal holds a college degree while this figure is 8 percent for Germany. With respect to the specialization of skills in the regions, the statistics reveal that specialization is on average higher in Germany, however also with a higher variation across the regions.

**Table 2: Descriptive statistics – Portugal**

Variable	Obs.	Mean	Std. Dev.	Min	Max
Entry – all industries	140	1471.26	1679.46	95	11311
Entry – high-/medium-high-tech	140	10.13	13.67	0	60
Entry – knowledge-intensive services	140	125.34	219.87	4	1419
Human capital	140	0.06	0.02	0.02	0.16
Skill specialization	140	0.33	0.19	0	0.62
Population (in logs)	140	12.21	0.89	10.02	14.49
GDP growth (%)	140	0.05	0.03	-0.05	0.15
Unemployment rate (%)	140	4.83	2.12	1.36	12.29

**Table 3: Descriptive statistics – Germany**

<b>Variable</b>	<b>Obs.</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
Entry – all industries	2195	558.67	884.35	47	14703
Entry – high-/medium-high-tech	2195	5.19	6.75	0	101
Entry – knowledge-intensive services	2195	72.34	158.61	0	2847
Human capital	2195	0.08	0.04	0.02	0.26
Skill specialization	2195	0.56	0.11	0.23	1.00
Population (in logs)	2195	11.90	0.63	10.48	15.04
GDP growth (%)	2195	1.98	3.62	-19.83	26.27
Unemployment rate (%)	2195	10.38	5.42	2.60	29.30

## 4.2 Estimation results

Results for Portugal from the negative binomial models are presented in Table 4. Regarding the first variable capturing the region’s skill base, human capital, we find a positive effect only for firm entries in knowledge-intensive services. The coefficient is not significant for entries in all industries or high- and medium-high-technology sectors. With respect to the second variable capturing the skill specialization, our results indicate that higher specialization propels firm entry in all sectors but particularly in high- and medium-high-technology. These results are in line with Rosenthal and Strange (2005), who found that for the US local area industrial specialization was positively related to new firm entry and employment growth among the new firms. They also found that the influence of this specialization decreases with distance. However, their results refer to the specific case of New York City, and do not account for skill composition. Also, van Oort and Stam (2006) using industrial concentration measures found that for the Netherlands concentration, competition and diversity all have positive effects on new firm formation. Nevertheless, this effect is felt stronger in knowledge dependent sectors. Baptista and Preto (2007) suggest that the creation of knowledge-based firms benefits from high levels of agglomeration and business dynamics to induce positive supply side spillovers that have a positive overall effect on subsequent employment change, but that this effect is not clearly true for other types of firms.

With respect to the control variables, a larger region in terms of population is also conducive to higher numbers of firm entry in all sectors. This indicates that both the local demand is higher but also the supply with labor. Regional GDP growth shows a negative significant effect on firm entries in high- and medium-high-technology sectors which is unexpected since higher economic dynamics should also propel entrepreneurial activity. Nevertheless, it is likely to assume that new firm entry in these sectors is less dependent on macro economic conditions, thus leading to this result. Moreover, we find that the unemployment rate has significant negative effects on firm entry in all sectors, with the effect on entry in high- and medium-high-technology sectors being the highest. This reveals that the formation of high-tech firms is not related to unemployment, since these firms are started by people with higher levels of qualification who are less likely to come from unemployment. In



fact, Zucker et al. (1998) found that the entry of new biotech firms is positively affected by the presence of star scientists, major universities, and federal research grants in a region. Highly skilled people are generally less likely to become unemployed.

**Table 4: Effects of skill specialization on firm entry in Portugal**

Explanatory Variables	Number of firm entries		
	All	High-med.-tech.	Knowl.-int. services
Human capital	0.661 (0.42)	4.054 (0.79)	8.945*** (3.47)
Skill Specialization	0.819** (2.48)	3.283*** (3.07)	1.168** (2.44)
Population (in logs)	1.023*** (15.35)	1.346*** (6.43)	1.068*** (10.80)
GDP growth	-0.272 (0.34)	-7.893*** (3.46)	-0.154 (0.14)
Unemployment rate	-0.041** (2.44)	-0.261*** (3.49)	-0.060** (2.12)
Year dummies	LR-Chi2(4)= 675.62***	LR-Chi2(4)= 47.88***	LR-Chi2(4)= 198.50***
Province dummies	LR-Chi2(4)= 290.76***	LR-Chi2(4)= 18.49***	LR-Chi2(4)= 100.59***
Constant	-6.091*** (8.00)	-14.980*** (6.29)	-9.573*** (8.05)
McFadden's R2	0.192	0.219	0.252
Cragg & Uhler's R2	0.930	0.761	0.946
N	140	140	140
Chi2	444.370	199.777	408.982
P-value	0.000	0.000	0.000

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; z-scores in parentheses; standard errors are clustered

Table 5 shows the results for Germany. Starting with the human capital, the results show positive and significant effects for all sectors, indicating that highly qualified employees matter considerably for entrepreneurial activity in a region. Interestingly, the effect of our specialization measure appears to be in full contrast to the results for Portugal. For Germany, our results show a negative effect of the specialization measure on firm entries in all sectors. As a consequence, it seems that higher diversity instead of higher concentration of skills increases entrepreneurial activity in Germany, providing support for the Jacobs diversity argument.

Regarding the control variables, similar effects can be observed for Germany. A higher population propels firm entry while the unemployment rate tends to have a negative effect on firm entry. Only the GDP growth leads to non-significant results. As outlined before, the models for Germany were re-run to check for robustness of the results using a regional aggregation level based on 150 labor market regions instead of the NUTS III level. The results obtained are consistent in that they do not change qualitatively. Due to the much lower sample size, however, some of the coefficients lose significance.

**Table 5: Effects of skill specialization on firm entry in Germany**

Explanatory Variables	Number of firm entries		
	All	High-med.-tech.	Knowl.-int. services
Human capital	2.302*** (5.14)	1.632* (1.92)	6.518*** (9.34)
Skill Specialization	-0.366*** (-2.72)	-0.428* (-1.65)	-0.662*** (-2.94)
Population (in logs)	0.972*** (43.98)	0.946*** (28.92)	1.011*** (28.76)
GDP growth	0.001 (0.88)	-0.004 (-1.05)	0.002 (0.86)
Unemployment rate	-0.006 (-1.22)	-0.033*** (-3.91)	-0.023*** (-3.38)
Year dummies	LR-Chi2(4)= 471.18***	LR-Chi2(4)= 30.62***	LR-Chi2(4)= 81.69***
Laender dummies	LR-Chi2(12)= 193.97***	LR-Chi2(12)= 38.38***	LR-Chi2(12)= 106.22***
Constant	-5.379*** (-18.84)	-9.317*** (-20.72)	-7.928*** (-16.95)
McFadden's R2	0.183	0.150	0.199
Cragg & Uhler's R2	0.930	0.562	0.878
N	2195	2195	2195
Chi2	6925.904	1982.703	3626.223
P-value	0.000	0.000	0.000

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01; z-scores in parentheses; standard errors are clustered

Our findings for the two countries are in stark contrast to each other which requires interpretation. While the specialization of skills seems to foster entrepreneurial activity in Portugal, it is diversity that propels firm entry in Germany. Hence, our results suggest that both specialization and diversity theories hold in the context of regional skill composition. We can attribute the different effects to differences in the institutional infrastructures for entrepreneurship in Portugal and Germany. They are apparently important moderators for the relationship between skill specialization, diversity and new firm entry.

## 5 Conclusion and implications

In this paper we analyze whether a more specialized or a more diverse skill composition in regions affects the level of new firm formation in general and in a number of knowledge-intensive subsectors. Our analysis is carried out in two countries: Germany and Portugal. We find that the skill composition has different effects on firm entry in the two countries. We find for Portugal that the specialization of skills has a positive effect on the levels of new firm entry in all sectors, and that this effect is particularly strong for high- and medium-high-tech firms. In contrast to this, our results for Germany reveal exactly the opposite effect for firm entry in all sectors. These results suggest that both specialization and diversity theories hold, and that the effect may thus depend on other more local and regional factors, i.e. specific institutional infrastructures for entrepreneurship. However, based on our models it remains an

open question how exactly these infrastructures come into play as we did not identify specific measures to address this issue. Future research should therefore try to explore the interaction between the regional skill base and institutional infrastructure for entrepreneurship.

There are also several implications that can be drawn from this study. Regional development policies directed at fostering entrepreneurial activity should acknowledge that both specialization and diversity of the regional skill base may benefit entrepreneurship instead of promoting, all too generally, the clustering of certain industries. Our research provides an indication that diversity may pay off most in a highly developed country context while specialization seems to be key in less developed countries. The reason for this may be that the effectiveness of knowledge spillovers is contingent to the institutional infrastructures and that the effectiveness may either be spurred through specialization or diversity. In addition, these results indicate that policy measures fostering new firm formation, especially in knowledge intensive sectors, should be considered on a more local level, considering the specificities of each region.

## References

- Acs Z. and Varga A. (2005) Entrepreneurship, agglomeration and technological change, *Small Business Economics*, 24, 323-334;
- Arrow K. (1962) The economic implications of learning-by-doing, *Review of Economic Studies*, XXIX (June), 155-173.
- Andersson R., Quigley J. M. and Wilhelmsson M. (2005) Agglomeration and the spatial distribution of creativity, *Papers in Regional Science*, 84, 445-464;
- Audretsch D. B. (2003) Innovation and Spatial Externalities, *International Regional Science Review*, 26, 167-174;
- Audretsch D.B. and Feldman M. (1996) R&D Spillovers and the Geography of Innovation and Production, *American Economic Review*, 86, 630-640;
- Audretsch D. B. and Feldman M. P. (2004) Knowledge spillovers and the geography of innovation, Chapter 61 in *Handbook of Regional and Urban Economics*, vol. 4, Amsterdam: Elsevier, 2713-39;
- Audretsch D.B. and Keilbach M. (2007) The localisation of entrepreneurship capital: Evidence from Germany, *Papers in Regional Science*, 86, 351-365;
- Audretsch D.B. and Keilbach M. (2008) Resolving the knowledge paradox: Knowledge-spillover entrepreneurship and economic growth, *Research Policy*, 37, 1697-1705;
- Baptista R. and Swann P. (1998) Do firms in clusters innovate more?, *Research Policy*, 27, 525-540;
- Baptista R. and Preto M.T. (2007) New Firm Formation and Employment Growth: Differences between Regions, 47th Congress of the ERSA, Paris, France, August 29th-September 2nd;
- Boschma R. and Lambooy J. (1999) Evolutionary economics and economic geography, *Journal of Evolutionary Economics*, 9, 411-429;
- Cohen W.M. and Levinthal D.A. (1989) Innovation and learning: the two faces of R&D, *The Economic Journal*, 99, 569-596;
- Cohen W.M. and Levinthal D.A. (1990) Absorptive Capacity: a new perspective on learning and innovation, *Administrative Science Quarterly*, 35, 128-152;
- Eckey H.F., Schwengler B. and Türck M. (2007) Vergleich von deutschen Arbeitsmarktregionen, IAB Discussion Paper No. 3/2007, Nuremberg;

- Faberman R.J. (2005) What's In a City? Understanding the Micro-Level Employer Dynamics Underlying Urban Growth, BLS Working Paper No. 386;
- Faria P and Sofka W. (2007) Formal and Strategic Knowledge Protection Strategies of Multinational Firms – A Cross Country Comparison, ZEW Discussion Paper No. 08-030, Mannheim;
- Feldman M.P. (1994) *The Geography of Innovation*, KluwerAcademic Press, Boston;
- Feldman M.P. (2001) The Entrepreneurial Event Revisited: Firm Formation in a Regional Context, *Industrial and Corporate Change*, 10, 861-891;
- Feldman M.P. and Audretsch D.B. (1999) Innovation in cities: Science-based diversity, specialization and localized competition, *European Economic Review*, 43, 409-429;
- Feldman M.P., Francis J. and Bercovitz J. (2005) Creating a Cluster While Building a Firm: Entrepreneurs and the Formation of Industrial Clusters, *Regional Studies*, 39, 129-141;
- Fritsch M. and Falk O. (2007) New Firm Formation by Industry over Space and Time: A Multi-Level Analysis, *Regional Studies*, 41, 157-172;
- Florida R. (1995) Towards the Learning Region, *Futures*, 27, 527-536;
- Gertler M.S. (1995) 'Being There': Proximity, Organization, and Culture in the Development and 'Adoption of Advanced Manufacturing Technologies, *Economic Geography*, 71, 1-26;
- Geroski P.A. (1995) What do we know about entry?, *International Journal of Industrial Organization*, 13, 421-440;
- Glaeser E.L., Kallal H.D., Scheinkman J.A. and Shleifer A. (1992) Growth in Cities, *Journal of Political Economy*, 100, 1126-1152;
- Griliches Z. (1979) Issues in Assessing the Contribution of Research and Development to Productivity Growth, *Bell Journal of Economics*, 10, 92-116;
- Henderson J.V. (1974) The Sizes and Types of Cities, *American Economic Review*, 64, 640-656;
- von Hippel E. (1994) 'Sticky Information' and the Locus of Problem Solving: Implications for Innovation, *Management Science*, 40, 429-439;
- Jaffe A.B. (1989) Real Effects of Academic Research, *American Economic Review*, 79, 957-970;
- Jacobs J. (1969) *The Economy of Cities*, London: Penguin Books;

- Jaffe A.B., Trajtenberg M. and Henderson R. (1993) Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations, *The Quarterly Journal of Economics*, 108, 577-598;
- Lee S., Florida R. and Acs Z. (2004) Creativity and Entrepreneurship: A Regional Analysis of New Firm Formation, *Regional Studies*, 38, 879-891;
- Lucas R. (1988) On the mechanics of economic development, *Journal of Monetary Economics*, 22, 3-42;
- Markusen A. (1996) Sticky places in slippery space: a typology of industrial districts, *Economic Geography*, 72, 293-313;
- Marshall A. (1920) *Principles of Economics*, 8th edition, Macmillan, London;
- OECD (2002) *Science, Technology and Industry*, Paris;
- Okamuro H. and Kobayashi N. (2005) The Impact of Regional Factors on the Start-Up Ratio in Japan, *Journal of Small Business Management*, 44, 310-313;
- van Oort F. and Stam E. (2006) Agglomeration economies and entrepreneurship: testing for spatial externalities in the Dutch ICT industry, *Papers in Evolutionary Economic Geography*, Utrecht University;
- van der Panne G. (2004) Agglomeration externalities: Marshall versus Jacobs, *Journal of Evolutionary Economics*, 14: 593-604;
- Romer P.M. (1990) Endogenous Technical Change, *Journal of Political Economy*, 98, S71-S102;
- Romer P.M. (1994) The origins of endogenous growth, *Journal of Economic Perspectives*, 8, 3-22;
- Rosenthal S.S. and Strange W.C. (2005) The Geography of Entrepreneurship in the New York Metropolitan Area, *FRBNY Economic Policy Review*, December 2005: 29-53;
- Shane S. (2000) Prior Knowledge and the Discovery of Entrepreneurial Opportunities, *Organization Science*, 11, 448-469;
- Simmie J. and Lever W.F. (2002) Introduction: The Knowledge based City, *Urban Studies*, 39: 855-857;
- Wood A. M., Watts H. D. and Wardle P. (2004) Growth-Oriented Small Firms and the Nature and Extent of Local Embeddedness: The Case of a Traditional Metalworking Cluster, *Growth and Change*, 35, 419-433;
- Zucker L., Darby M.R. and Armstrong J. (1998) Intellectual Human Capital and the Birth of U.S. Biotechnology Enterprises, *American Economic Review*, 88, 290-306.