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and New Firm Formation

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Abstract:
Does regional unemployment increase or rather decrease entrepreneurial activity? Although this question has been hotly debated among researchers for decades the answers yielded so far are ambiguous and inconclusive. The paper proposes an innovative approach that takes not only interregional differences in unemployment rates, but also in unemployment duration and the human capital of the unemployed—i.e. in the structure of regional unemployment—into account. Both, the skill structure of the unemployed and the share of long-term unemployment are found to have an important impact on regional start-up activity. Moreover, the impact of unemployment structure on new firm formation is found to vary with the knowledge-intensity of the start-ups.

Keywords: regional unemployment, new business formation, skill structure, long-term unemployment.

JEL classification: M13, R12, J64

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1.   Introduction

Scholars have devoted considerable attention to unravelling the relationship between unemployment and entrepreneurship, or the start-up of new businesses. On the one hand, the model of entrepreneurial choice prevalent in the labour economics literature suggests that higher levels of unemployment will induce more people to making the decision to enter into entrepreneurship (Taylor, 1996; Parker, 2009). According to Blau (1987), Evans and Jovanovic (1989), Evans and Leighton (1990) and Blanchflower and Meyer (1994), the opportunity cost of starting a new business decreases as the likelihood of unemployment increases. Hence, according to this view, higher rates of unemployment *push* people into making a choice for entrepreneurship due to a lack of employment opportunities.[1] On the other hand, a very different but also massive literature in regional economics has argued that entrepreneurial opportunities are less prevalent in regions with higher unemployment. According to this view, lower rates of unemployment typically reflect a region characterized by higher levels of demand and growth as well as an abundance of entrepreneurial opportunities. Such regions have a prevalence of demand-induced entrepreneurial activities, suggesting that the *pull* of such opportunities triggers entrepreneurial activity (Reynolds, Storey and Westhead, 1994; Reynolds, Miller and Maki, 1995; Storey, 1991).

Attempts to empirically unravel the relationship between entrepreneurship and unemployment have resulted in what has been characterized as ambiguity and confusion (Armington and Acs 2002, Audretsch et al. 2005). While some studies have empirically validated the *push perspective*, others have found empirical results consistent with the *pull hypothesis* (see Section 2 for a more detailed discussion). However, one aspect that studies generating these disparate results have in common is that they all treat unemployment as an unequivocal, homogeneous economic status. Such a gross characterization, treating all unemployed as being the same, flies in the face of both labour economics theory and empirical evidence. In fact, labour economics has long identified unemployed workers as consisting of very heterogeneous and disparate individuals with very different incentives and opportunities to become self-employed (Feldstein, 1973; Evans and Leighton,

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[1] It is important to note that necessity is not the only – and in many cases not the most important – motivation of unemployed people to become self-employed. See, for instance, Brünjes and Revilla-Diez (2012, 2013) for an in-depth discussion of push and pull factors of entrepreneurship in a rural developing context.

1990; Summers, 1990). The purpose of this paper is to try to resolve the ambiguity and confusion prevalent in the literature on the link between regional unemployment and entrepreneurship by allowing for heterogeneous states or types of unemployment and focussing not just on the overall level of unemployment but on its regional structure in terms of unemployment duration and human capital of the unemployed.

The paper is organized as follows: Section 2 reviews findings from previous research and makes clear that the complex relationship between unemployment and entrepreneurship is not well understood as yet. Section 3 proposes an alternative approach that explicitly takes unemployment duration and skill structure of the unemployed into account and provides the main hypotheses. Section 4 describes the empirical approach, the data and the variables used in the analysis. Section 5 presents and discusses the results of the empirical analysis. Section 6 summarizes the main findings and concludes.

2.   Unemployment and entrepreneurship: An ambiguous relationship

The nature of the relationship between unemployment and entrepreneurship is a complex one and has puzzled researchers for decades. The discussion dates back at least to Oxenfeld (1943) who argued that individuals with low prospects of wage employment tend to become self-employed. This suggested link between unemployment and entrepreneurship has been referred to as the *unemployment push*-hypothesis as, according to this view, higher rates of unemployment *push* people into making a choice for entrepreneurship due to the lack of employment opportunities. The opposite view, referred to as *pull*-hypothesis, emphasizes that lower rates of unemployment suggest economic strength, higher levels of demand and growth, and ample entrepreneurial opportunities that *pull* individuals into entrepreneurial activity.[2]

Both hypotheses appear—from a theoretical point of view—equally plausible, and a choice between them can only be made on the basis of sound empirical analyses. Unfortunately, however, the empirical evidence

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[2] The relationship between unemployment and entrepreneurship may be further complicated by the fact that there may be – at least in the longer run – reversed causality in the sense that self-employment rates influence unemployment rates. This possibility is not discussed in detail here, but great care is taken in the empirical part of the paper to control for possible endogeneity of the unemployment variables.

so far is rather inconclusive and ambiguous, as can be seen from Table 1, which provides an overview of some of the most prominent empirical work in the field.[3]

[insert Table 1 around here]

Early empirical work based on time series analysis has typically found support for the *push*-hypothesis. For example, Evans and Leighton (1990) have provided empirical evidence for the US, showing that unemployed individuals are about twice as likely to become self-employed than wage-employed individuals. Storey (1991), who has reviewed early empirical evidence for the UK, reports that there is strong evidence in favor of the *push*-hypothesis. He argues, however, that the results depend partly on the methodology; there is a tendency for time series analyses to detect evidence for a positive impact ('push effect') and for cross sectional analyses to find a negative impact ('pull effect') of unemployment on new firm formation. However, later work has challenged Storey's famous dictum: Although there is ample evidence for a negative impact based on regional cross-sectional analyses for a variety of countries (see the third column of Table 1), there are also cross-sectional analyses that point into the opposite direction (e.g. Guesnier 1994, Lee et al. 2004 or Fritsch and Falck 2007), or find mixed results or no significant effect at all (e.g. Armington and Acs 2002, Ritsilä and Tervo 2002, Sutaria and Hicks 2004).[4] Moreover, a more recent time-series analysis for the U.S. finds no significant relationship between unemployment and entrepreneurship (Choi and Phan 2006).

In sum, after more than 30 years of empirical research, the impact of unemployment on entrepreneurship remains "shrouded with ambiguity" (Audretsch et al. 2005.) It is therefore time to dig deeper and take the regional structure of unemployment into account.

3. Theoretical Framework and Main Hypotheses

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[3] Table 1 is not meant to give a complete and exhaustive overview of all relevant work in the field. Its purpose is simply to contrast some of the most prominent studies and to illustrate how contradictory and ambiguous the empirical evidence in fact is.

[4] See colums 1 and 2 of Table 1 for further evidence.

The large majority of work discussed in Section 2 treats unemployment as an unequivocal, homogeneous economic status[5], which is at odds not only with labour economics theory but also with empirical evidence. In fact, labour economists have identified unemployed workers as consisting of very disparate individuals (Summers, 1990; Taylor, 1996), and regional labour market statistics show substantial cross-regional differences in unemployment duration and human capital of the unemployed. This is illustrated in Figures 1 to 3 which indicate that the spatial patterns of the level and structural characteristics of regional unemployment in Germany differ considerably.[6]

[insert Figures 1 to 3 around here]

Figures 1 to 3 suggest that there exists valuable unemployment-related information at the regional level which has not been exploited in the literature on regional unemployment and entrepreneurship as yet. The main innovation of the current paper is, therefore, not just to link regional unemployment rates but rather the *structure of regional unemployment* to entrepreneurship. The principal argument for the new approach is as follows:

According to Frank Knight (1921) individuals in the labour force allocate their time and ability among three principal activities: wage-employment, unemployment, and self-employment.[7] An unemployed person will only choose self-employment over unemployment if her expected utility from self-employment exceeds that from unemployment. The basic argument underlying the *unemployment push*-hypothesis is that unemployment is the least attractive of the three Knightian alternatives, and the best that unemployed people with poor prospects of wage-employment can do to maximize their utility is to become self-employed. This simple argument suggesting that unemployed individuals are quasi-automatically pushed into self-employment, however, neglects the fact that '*the unemployed*' are a rather heterogeneous group with respect to their attitudes, their ability, and their expected returns to entrepreneurship. Since there are marked differences between unemployed people, some unemployed individuals are more likely to be "pushed" into entrepreneurship than others.

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[5] A notable exception is the study by Fritsch and Falck (2007) who differentiate between short-term and long-term unemployment.
[6] Figure 2 displays the share of highly qualified unemployed in total unemployment, whereas Figure 3 displays the share of long-term unemployed (longer than one year) in total unemployment.
[7] Although it is possible that people combine activities, most individuals fall exclusively in one of the three categories.

The core proposition of the current paper is that people with higher levels of human capital (as measured by highest educational attainment) behave quite differently from people with medium or low levels of human capital when they are faced with unemployment. The rationale for this proposition is threefold:

(i) People with higher educational attainment have, on average, higher career aspirations than people with low levels of education (Yuchtman and Samuel 1975, Jacobs et al. 1991). This implies that they are less willing to accept the status of an unemployed person and more likely to pursue alternative career paths such as entrepreneurship when they are faced with or threatened by unemployment.

(ii) It is well established in the literature that the returns to entrepreneurship have a much higher variance than returns to being an employee (Hamilton 2000, Moskowitz and Vissing-Jorgensen 2002, Cagetti and De Nardi 2006) and that high-ability agents have particularly high potential benefits from being an entrepreneur. Hence, entrepreneurship appears to be a particularly attractive alternative for highly qualified people confronted with unemployment.

(iii) It is also well documented that firm founders' educational attainment has a positive impact on new firm survival (Bates 1990, Cooper et al. 1994, Acs et al. 2007), and it is therefore consequent to assume that highly qualified people are more confident of mastering the challenges of self-employment.

Against this background, it appears quite plausible that people with high levels of educational attainment are more likely to opt for self-employment when facing unemployment or job loss than people with medium or low levels of education. On the other hand, it is often argued that people with particularly low levels of human capital have lower opportunity costs and are therefore more likely to opt for self-employment than others (see, for instance, Lazear, 2005 or Poschke, 2008). Taking both arguments together suggests a U-shape relationship between the human capital of the unemployed and their incentives to become self-employed. Transferring these individual-level arguments to the regional level obviously implies that interregional differences in the *human capital structure*[8] of the unemployed should matter for regional start-up activity.

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[8] The terms *human capital structure* and *skill structure* are used synonymously.

More specifically, the U-shape hypothesis implies that higher shares of either particularly high or particularly low qualified unemployed lead, ceteris paribus, to higher regional start-up activity.

As highly qualified people start their own businesses primarily in fields in which they can make use of their specific human capital, it is expected that the impact of highly qualified unemployed on start-ups is strongest in knowledge-intensive industries.[9] For the same reason, we do not expect to find a positive effect of a high percentage of high-skilled unemployed on start-ups in low-knowledge industries[10] or on total start-ups. An analogous argument holds for the low qualified unemployed. A high share of low qualified unemployed is expected to have a positive impact on low-knowledge start-ups but not on knowledge-intensive or total start-ups.

Moreover, there is rich evidence in the labour economics literature that a long duration of unemployment leads to a deterioration of human capital, regardless of its initial level (Mincer and Ofek 1982, Möller 1990, Pollak 2012), such that long-term unemployed face lower returns to self-employment and are likely to feel less confident to meet the challenges of entrepreneurship. Hence, in addition to the above-named factors characterizing the educational structure of regional unemployment, the share of long-term unemployed (i.e. people who are unemployed for one year or longer) in total regional unemployment is considered as a further possible determinant of regional start-up activity. According to the above-mentioned arguments on depreciation of human capital, it is expected that a high share of long-term unemployed in a region has a negative impact on all kinds of start-ups, regardless of their knowledge content.

The above discussion is summarized in one general (H1) and five more specific (H2—H6) hypotheses:

H1: Structural features of regional unemployment such as the human capital structure of the unemployed or the share of long-term unemployed have a significant influence on regional start-up intensity.

H2: A high share of highly qualified unemployed has a positive impact on regional start-up rates in knowledge-intensive industries.

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[9] Examples for knowledge-intensive industries include business services, high-tech manufacturing, or information and communication technologies (ICT).
[10] These include industries such as retailing, construction, or consumer services.

H3: A high share of highly qualified unemployed has no impact on regional start-up rates in low-knowledge industries and on total start-up rates.

H4: A high share of low qualified unemployed has a positive impact on regional start-up rates in low-knowledge industries.

H5: A high share of low qualified unemployed has no impact on regional start-up rates in knowledge-intensive industries and on total start-up rates.

H6: A high share of long-term unemployed in a region has a negative impact on all kinds of start-ups, regardless of their knowledge content.

The following sections analyze hypotheses H1—H6 empirically.

4.   Model Specification & Measurement

4.1   Model

This section specifies the econometric model that is applied to investigate the impact of both unemployment level and structure of unemployment on entrepreneurial activity. The starting point is a large empirical literature that provides evidence on various regional characteristics which affect regional firm birth rates. Factors that have turned out to be important determinants of entrepreneurial activity are, among others, regional demand (disposable regional income), economic growth, R&D activities, manufacturing density and the firm size structure characterizing the particular region (see, for instance, Armington and Acs 2002, Lee et al. 2004 or Audretsch et al. 2010).

As explained in the previous section, many of these studies have included a measure of unemployment as an important region-specific characteristic, and in most cases, the focus is on the regional unemployment rate u_{it}. While this general measure is included in our model as well, our focus is on indicators reflecting the structure of unemployment, namely the share of long-term unemployed in total regional unemployment (ltu_{it}) and the share of different skill groups in total regional unemployment (sh_{it}^q). The unemployed are subdivided into three qualification groups: low-, medium-, and high- skilled unemployed.

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The basic version of the econometric model is given by:

$$(1) \qquad SU_{it} = \alpha_0 + \alpha_1 u_{it} + \alpha_2 sh_{it}^q + \alpha_3 ltu_{it} + \sum_{n=1}^{N} \beta_n C_{nit} + \varepsilon_{it}$$

where SU_{it} is the start-up intensity (start-ups per 10.000 inhabitants) in region i and year t, sh_{it}^q is the share of qualification group q in total unemployment, ltu_{it} is the share of long-term unemployed in total regional unemployment and C_{nit} is control variable n in region i and period t. As it is by now well established that the capability of economic agents to generate entrepreneurial activity is not invariant to regional context (Capello 2002, Acs et al 2009, Capello et al. 2009), our regional-level control variables include measures of disposable regional income, growth, R&D activities, manufacturing orientation and the firm size structure of the region. Spatial lags of disposable income and of the growth rate of disposable income are considered as well, since the spatial range of demand linkages and growth spillovers likely exceeds the borders of our observational units. As robustness checks, the basic model given by equation (1) is extended to include additional controls such as the vacancy rate, the net migration rate, indicators for sectoral diversity of the regional economy, and cultural diversity of the regional work force. Systematic differences in entrepreneurial activities between East and West Germany are also considered. The white noise error term is denoted as ε_{it}. In order to investigate whether the impact of labour market conditions on start-ups differs across knowledge levels of the new firms, the regression models are estimated for different start-up rates, i.e. it is distinguished between total start-ups, knowledge-intensive start-ups, and low-knowledge start-ups.[11]

To account for unobserved heterogeneity and in order to further check the robustness of results emerging from the pooled model given by equation (1), additional regression models are applied. Panel data models are used to control for unobserved time-invariant explanatory variables:

$$(2) \qquad SU_{it} = \alpha_0 + \alpha_1 u_{it} + \alpha_2 sh_{it}^q + \alpha_3 ltu_{it} + \sum_{n=1}^{N} \beta_n C_{nit} + \eta_{it} + v_{it}$$

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[11] The classification of start-ups in different industries according to their knowledge intensity is detailed in Section 4.2.

where η_i denotes a region-specific effect, controlling for unobservable regional characteristics that are time-invariant, and v_{it} is a white noise error term. As evidenced by Table 3 in the Appendix, the large majority of variables are characterized by a rather low within variation as compared to the between variation, such that random effects estimation is the appropriate procedure in place (see e.g. Griliches and Hausman 1986). Quite obviously, the fixed-effect estimator would only exploit the within variation and leave unused the major part of information that is incorporated into the cross-sectional dimension. Fixed effects estimation, therefore, likely results in weakly identified coefficients and will not allow an accurate determination of causal effects because the cross sectional variation cannot be used for identification (see Hausman and Taylor 1981).[12]

The majority of work on regional unemployment and entrepreneurship does not take the possibility of reversed causality into account.[13] The estimated effects of unemployment and the unemployment structure on regional start-ups might, however, be biased since newly founded firms are – at least in the longer run – likely to have an influence on local labour demand and thus unemployment. Potential endogeneity of some influential factors is addressed by using predetermined explanatory variables and applying instrumental variable (IV) estimation. In order to identify the causal impact of unemployment on new firm formation, the unemployment rate and the corresponding structural indicators are instrumented by lagged shares of different qualification groups in total employment and the employment share of older workers (50 to 65 years). The lagged skill structure of employment is used in order to approximate differences in employment opportunities of low- and high-skilled workers across regional labour markets. Such structural characteristics are rather persistent and show a strong correlation with skill-specific unemployment indicators. For similar reasons, the employment share of older workers is applied as an instrument. This age group suffers from above average unemployment in Germany, and a high percentage of older employees might point to a demographic burden for the regional labour market conditions and high unemployment. Moreover, we consider the lagged

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[12] Moreover, the attenuation bias that is due to mismeasurement of variables can be aggravated by fixed effects estimation, in particular if the explanatory variables are highly correlated across time, as is frequently the case when the time period between the two cross sections is small (see e.g. Griliches and Hausman 1986).With respect to the data set used in the regression analysis, this applies to the majority of variables (see Table A3 in the appendix). Although there is a considerable variation across regions, there is much less variation across time.

[13] There are, however, some studies (Schröter 2011, for instance) explicitly dealing with the opposite effect.

unemployment rate as additional instrument. All instruments are lagged by 5 years (see Spilimbergo 2009, Green et al. 2005 or Clemens et al. 2012 for similar instrumentation strategies). All instruments applied are obviously unaffected by subsequent start-ups and all are highly correlated with the respective explanatory variables.[14]

Finally, one might consider spillover effects among neighbouring regions. The regional units of observation approximate regional labour markets, and thus, spatial interaction should mainly take place within the observational units. However, there might nevertheless be significant effects across the borders of regional labour markets. Entrepreneurs likely consider conditions such as disposable income or growth in nearby locations. Therefore spatial lags of some explanatory variables are introduced in the regression model to account for spillovers that cross regional boundaries.

4.2 Measurement Issues

The cross section consists of 97 functional regions, the so-called *Raumordnungsregionen*, which comprise several counties (NUTS 3 level) linked by intense commuting. Thus, the aim is to approximate regional labour markets. The dependent variable is the start-up intensity, i.e. the number of new firms per 10.000 inhabitants. More precisely, 4-year averages (1998-2001 and 2002-2005, respectively) of firm birth rates are used in the regression analysis.[15]

Total start-ups are considered as well as firm foundation at different technology levels. In the remainder of the paper, the focus is on three different groups, namely total start-ups (*Su_all*), knowledge-intensive start-ups (*Su_ht*), and low-knowledge start-ups (*Su_lt*). The different groups of start-ups are classified according to economic sectors. Knowledge-intensive firm foundation encompasses technology-oriented services, cutting-edge and high-tech manufacturing, knowledge-intensive consulting services, and ICT. The low-

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[14] Moreover, there is little reason to think that our instrumental variables have a direct impact on start-up intensity.
[15] This is in line with recommendation of the data provider (ZEW Mannheim) and accounts for the high annual variation in birth rates.

knowledge branches comprise construction, wholesale and retail trade, transportation and storage, and consumer-oriented services.[16]

Information on several explanatory variables is taken from the employment and unemployment statistics of the German Federal Employment Agency (FEA). The employment statistics covers all employment subject to social security contributions and refers to workplace location.[17] Information on our most important explanatory variables—the regional unemployment rate, regional unemployment by educational attainment of unemployed, and unemployment duration—comes from the unemployment statistics of the FEA. In regard to the percentages of skill groups among the unemployed, a distinction is made between low-skilled (no formal vocational qualification), medium-skilled (completed apprenticeship), and high-skilled (university degree) unemployed. Long-term unemployed are characterized by a duration of unemployment of at least 12 months. The information on vacancies also comes from the FEA. The vacancy rate is defined as the ratio of vacancies to regional labour force. Finally, migration figures provided by the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) are used. The migration flows include changes of residence of the age group 25 to 50 years.

5. Empirical Results

5.1 The Impact of Regional Unemployment Structure on New Firm Formation

The results from estimating Equation (1), i.e. the pooled model for the three different start-up rates, are provided in Table 2. The columns (1) and (2) refer to total start-ups, and the columns (3) to (6) summarize the estimates for knowledge-intensive and low-knowledge start-ups. The two specifications that are displayed for every dependent variable just differ with respect to the inclusion of the unemployment structure. In order to account for the heterogeneity of the unemployed, the basic specification is augmented with the share of high-skilled unemployed and the share of long-term unemployed in total regional unemployment. The explanatory power of the models varies considerably with the dependent variable. The share of the regional

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[16] A detailed description of the data set and the classification of start-ups according to their knowledge content can be found in the documentation by Metzger and Heger (2005).

[17] Hence, civil servants and self-employed are not recorded in the employment statistic. Employment figures are differentiated by sector, level of educational attainment, occupation and nationality and used to construct several control variables such as the share of R&D employment, sectoral and cultural diversity. Moreover, some instrumental variables base on regional employment data.

variation in start-up rates that is explained by the regression models without unemployment structure ranges from 26% for low-knowledge firm foundation up to 67% for knowledge-intensive new firms. Comparing the specifications with and without unemployment structure in Table 2 reveals that the consideration of unemployment structure substantially increases the explanatory power, irrespective of the kind of start-up investigated.

[insert Table 2 around here]

The regression results displayed in table 2 indicate that both the percentage of highly skilled unemployed and the significance of long-term unemployment matter for entrepreneurial activities in the region. However, the share of unemployed persons with a university degree only affects knowledge-intensive start-ups, whereas the share of long-term unemployed (negatively) affects all kinds of new firm foundation. Taken together, these findings confirm theoretical expectations as outlined by the hypotheses H1–H3 and H6 in Section 3.

The results also show that considering the heterogeneity of the unemployed has consequences for the estimated effect of the regional unemployment rate as well. When structural features of regional unemployment are not considered, the unemployment rate has a significant negative impact on total entrepreneurial activities and on knowledge-intensive start-ups (columns 1 and 3 in Table 2), whereas the unemployment rate variable has a negative sign but is not significant in the case of low knowledge start-ups (column 5 in Table 2). The inclusion of the two structural indicators drives the impact of the unemployment rate to insignificance in the case of total start-ups (column 2). The effect of the unemployment rate on knowledge-intensive firm foundation remains significant; however, its size is reduced in the extended model as compared to the basic specification (column 4). These findings further confirm that structural features of regional unemployment matter and must not be neglected in cross regional analyses of new firm formation.

As concerns the *control variables*, the disposable income of a region (denoted as *income* in Table 2) tends to have a positive impact on start-up intensity, whereas the manufacturing orientation of a region and the

growth rate of neighbouring regions (*W_income growth* in Table 2) appear to exert a dampening influence.[18] The share of R&D employees in total regional employment (denoted as *R&D-intensity*) has a positive impact on knowledge-intensive start-ups and on total start-ups, but is not significant in the case of low knowledge start-ups.[19] Moreover, a high share of employees in small firms (less than 20 employees) tends to push start-up intensity, although this effect is not robust in all specifications. Overall, the results for the control variables are plausible and confirm the findings from earlier research (see, for instance Armington and Acs, 2002, Audretsch and Keilbach 2007 or Audretsch et al. 2010).

5.2   Robustness of the Results

In Table 3, the results of a series of robustness checks are summarized. The columns (1) to (6) show estimates of a panel estimation, whereas the columns (7) to (12) refer to IV estimation with random effects. Table 3 only displays the results for the three unemployment variables.[20] The major findings of the pooled regressions are confirmed by these additional analyses. In regards to the random effects estimates, we refrain from a detailed discussion of the findings, since for most regressors one observes merely marginal changes in the size of the coefficient as compared to the pooled models. The only notable change is that, concerning the influence of long-term unemployment on knowledge-intensive start-ups, one cannot detect any significant correlation when controlling for unobserved time-invariant heterogeneity. IV estimations give rise to some more pronounced changes, indicating that inverse causality might indeed affect the regression analyses that ignore the potential endogeneity of the unemployment variables. The absolute size of the effects tends to increase when instrumenting the unemployment rate and the structural indicators. However, the basic evidence concerning the effects of unemployment structure on new firm formation appears to be very robust: A high percentage of highly skilled unemployed pushes knowledge-intensive start-ups, whereas a high share of long-term unemployment dampens total start-up activity and low knowledge start-ups.

[insert Table 3 around here]

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[18] The dominance of (large) manufacturing firms in a region is often seen as a barrier to entry of newcomers, while the negative impact of growth in neighbouring regions points to competition between neighbouring areas, i.e. regions marked by a dynamic development of disposable income might attract entrepreneurs from neighbouring locations, thus reducing the firm birth rate there.

[19] Quite obviously, the importance of regional R&D is the higher, the more knowledge intensive the start-ups are (Revilla-Diez 2002, Audretsch and Keilbach 2007).

[20] The estimates for the control variables as well as first stage results are available from the authors upon request.

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To deal with possible left-out variable bias, further models have been estimated that include the vacancy rate, the net migration rate, sectoral diversity of the regional economy, and cultural diversity of the regional work force.[21] The vacancy rate might point to the availability of alternatives to starting a new business for unemployed. In-migration of working age population might also have an impact on new firm foundation via different channels. However, in most specifications, the coefficients of the additional controls turned out to be insignificant. Though there is some indication that sectoral and cultural diversity matter for entrepreneurship, their inclusion does not change the principal results concerning the impact of unemployment rate and unemployment structure on entrepreneurship. Moreover, another robustness check allows for systematic differences in entrepreneurial activities between East and West Germany, but it is refrained here from including a corresponding dummy variable in the model because the dummy is highly correlated with all unemployment indicators (correlation coefficients > 0.8). Instead interaction terms are introduced that allow for differentiated influence of unemployment in both parts of the country. However, the interaction effects turned out to be insignificant or not robust to changes of the estimation method. In sum, these different robustness checks do not result in important changes of the main findings and, in particular, of the impact of regional unemployment and its structure on start-ups.[22]

Finally, Table 4 shows results for some additional specifications where the share of high-skilled unemployed is substituted by the percentage of low-skilled.[23] The estimates for the unemployment rate and long-term unemployment are not discussed in detail here since only minor changes with respect to the size of the coefficients are triggered by considering the share of unskilled unemployed instead of the university graduates without a job. The main finding from these regressions is that they provide no support for the idea that a high percentage of low skilled unemployed stimulates new firm foundation. This result is independent of the knowledge content of the start-ups, suggesting that the low skilled unemployed offer no specific potential for entrepreneurship at all. While this has been expected for knowledge-intensive start-ups and total start-ups (hypothesis H5), it is in contrast to theoretical expectations (summarized in hypothesis H4), suggesting that a high share of low qualified unemployed pushes regional start-up rates in low-knowledge industries.

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[21] See Audretsch et al. (2010) for a detailed analysis of the relationship between regional start-ups and diversity of the regional economy and labor force. Estimates of all additional robustness checks are available from the authors upon request.

[22] Estimates of all additional robustness checks are available from the authors upon request.

[23] Estimates for the share of medium skilled unemployed are not reported here, but are available from the authors upon request.

While surprising at first glance, this finding may be explained by the fact that support for the unemployed is relatively generous in Germany, such that the 'low qualification – low opportunity cost'-argument underlying hypothesis 4 might not hold in the German context. This explanation is in line with earlier work by Reynolds et al. 2002 and Acs et al. 2005 who argue that countries with more supportive welfare programs tend to have lower rates of entrepreneurship out of necessity.

[insert Table 4 around here]

6. Summary and conclusions

The nature of the relationship between regional unemployment and entrepreneurship has puzzled researchers for decades. This paper argues that part of the ambiguity and confusion may be due to the fact that empirical research so far has failed to take structural characteristics of regional unemployment into account. The current paper is—to the best of our knowledge—the first to take both the *skill structure of the unemployed* and the *share of long-term unemployed* into account when analysing the impact of unemployment on entrepreneurship. It provides an in-depth empirical analysis yielding a number of important and highly policy relevant results.

First, and most important, findings confirm that structural features of regional unemployment have a significant influence on regional start-up intensity (hypothesis H1). A second major result is that the regional unemployment structure impacts different kinds of start-ups differently, according to their knowledge content. In line with expectations, it is found that a high share of highly qualified unemployed has a positive impact on knowledge-intensive start-ups (hypothesis H2), but not on total start-ups and low-knowledge start-ups (hypothesis H3). By contrast, no evidence is found that a high share of low-qualified unemployed pushes low-knowledge entrepreneurship (or any other kind of entrepreneurship), i.e. hypothesis H4 is not supported by the data. A possible explanation for this "non-finding" is that because of the relatively generous support for the unemployed in Germany, the 'low qualification – low opportunity cost'-argument might not hold in the German context.

Concerning the duration of unemployment, it is found that it is long-term unemployment rather than overall unemployment that discourages new firm formation in sectors with low- or medium-knowledge content. In other words: A high share of long-term unemployed appears to be a major handicap for new venture creation in these sectors. A somewhat different picture emerges, again, for knowledge-intensive start-ups: The impact of the share of long-term unemployed on knowledge-intensive start-ups is ambiguous[24], whereas knowledge-intensive start-ups appear to be the only ones that are (negatively) affected by the overall unemployment rate. A possible interpretation for the finding that long-term unemployment seems to matter less for knowledge-intensive start-ups is that founders of knowledge-intensive firms are most often highly skilled people – a group that is typically less affected by long-term unemployment.

In sum, the results suggest that structural features of regional unemployment play an important and, so far, largely underestimated role for a better understanding of the impact of unemployment on entrepreneurship. A regional structure of unemployment characterized by a high share of highly qualified unemployed pushes knowledge-intensive firm start-ups, indicating that highly qualified people react to the challenge of unemployment in a different (more pro-active and entrepreneurial) way than people with a lower qualification level. By contrast, a regional structure of unemployment characterized by a high share of long-term unemployed appears to be a major obstacle to new firm formation, in particular in medium- and low-knowledge sectors.

The findings have important implications for policy. First, it is important for policy makers to get acquainted with the structural features of unemployment in their region. Programs intended to turn unemployed into entrepreneurs find, all else equal, a better seedbed in regions characterized by a high share of highly qualified unemployed and a low share of long-term unemployed. Moreover, the finding that the regional determinants of start-ups vary substantially across different groups of start-ups (according to their knowledge content) suggests that "one size fits all" policies appear less suitable than policies that distinguish start-ups of different knowledge-intensity and take their particular needs into account.

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[24] In the pooled OLS-regression a significant negative impact is found, but this result is not confirmed in the random effects and instrumental variables estimations.

An important qualification is that the results of this paper are in the context of a leading European economy. Whether the structure of unemployment exerts a similar influence on entrepreneurship in different economic contexts remains open to future research.

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Tables and Figures

Table 1: Impact of unemployment on entrepreneurship (overview of previous studies)

Positive Impact	No significant impact / mixed results	Negative Impact
Evans, Leighton (1989, 1990) US National Longitudinal Survey of Young Men; US Current Population Surveys Individual unemployment Spell (Weeks of UE)	**Reynolds, Storey, Westhead (1994)** Cross-national comparative study Regional UE (and change in UE)	**Tervo, Niitykangas (1994)** Finnish municipalities Local unemployment rate
Storey (1991) Review of empirical evidence for UK	**Blanchflower, Oswald (1998)** UK regions Regional UE-rate	**Garofoli (1994)** Italian regions (provinces) Regional UE rate (change in UE rate)
Guesnier (1994) French regions Regional UE rate	**Armington, Acs (2002)** US regions (LMAs) Regional UE rate	**Reynolds, Miller, Maki (1995)** US regions (LMAs) Regional UE rate
Lee, Florida, Acs (2004) US regions (LMAs) Regional UE rate	**Ritsilä, Tervo (2002)** Finnish regions Dummy for regions with high UE	**Taylor (1996)** UK, British Household Panel Study Local UE/Vacancies-rate
Lasch, Gundolf, Kraus (2007) French LMAs Regional UE rate	**Sutaria, Hicks (2004)** US (Texas) MSAs and PMSAs, Regional UE rate	**Santarelli, Caree, Verheul (2009)** Italian provinces, Regional UE-rate
Fritsch, Falck (2007) West-German regions Short-term regional UE rate	**Choi, Phan (2006)** New firm formation time series for US Share of unemployed in civil labour force	**Audretsch, Dohse, Niebuhr (2010)** German regions Regional UE-rate

Source: Own compilation.

Table 2: Determinants of start-up intensity – pooled regression

	all start-ups		knowledge-intensive		low knowledge	
	(1)	(2)	(3)	(4)	(5)	(6)
unemployment rate	-0.374*	-0.239	-0.174***	-0.115***	-0.122	-0.076
	(0.18)	(0.18)	(0.03)	(0.03)	(0.13)	(0.13)
income	0.024**	0.024**	0.007***	0.007***	0.013**	0.013*
	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)
W_income	-0.023*	-0.013	-0.006*	-0.003	-0.010	-0.005
	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
income growth	0.645	-0.491	0.097	-0.025	0.329	-0.475
	(0.63)	(0.62)	(0.11)	(0.12)	(0.49)	(0.48)
W_income growth	-1.570	-2.943***	-0.511***	-0.635***	-0.896	-1.893**
	(0.86)	(0.81)	(0.14)	(0.14)	(0.66)	(0.63)
small firms	0.564*	0.299	0.129*	0.135**	0.418*	0.193
	(0.27)	(0.24)	(0.05)	(0.04)	(0.19)	(0.17)
large firms	0.096	0.079	0.032	0.040	0.101	0.079
	(0.14)	(0.13)	(0.02)	(0.02)	(0.10)	(0.10)
research&development	1.541**	1.494**	0.682***	0.576***	0.517	0.594
	(0.53)	(0.53)	(0.12)	(0.11)	(0.37)	(0.39)
manufacturing orientation	-0.857**	-0.849***	-0.157**	-0.095*	-0.618**	-0.678***
	(0.26)	(0.24)	(0.05)	(0.04)	(0.19)	(0.17)
high-skilled unemployed		-0.012		0.201**		-0.229
		(0.36)		(0.07)		(0.26)
long-term unemployed		-0.539***		-0.063***		-0.376***
		(0.12)		(0.02)		(0.09)
constant	30.404*	60.783***	1.299	1.840	22.322*	46.779***
	(14.85)	(14.32)	(2.70)	(2.55)	(10.43)	(10.32)
R^2	0.313	0.384	0.669	0.706	0.261	0.333
F-Statistic	9.030	13.165	21.454	20.691	8.253	11.076

Notes: robust standard errors in parentheses. * significance at the 0.05 level, ** significance at the 0.01 level, *** significance at the 0.001 level.

Table 3: Effects of high skilled and long-term unemployment on start-up intensity – panel estimation and IV results

| | Random effects | | | | | | Random effects IV | | | | | |
| | all start-ups | | knowledge-intensive | | low knowledge | | all start-ups | | knowledge-intensive | | low knowledge | |
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
unemployment rate	-0.425*	-0.321	-0.167***	-0.144***	-0.213	-0.179	-0.089	-0.244	-0.213***	-0.126*	0.013	-0.206
	(0.20)	(0.21)	(0.03)	(0.03)	(0.15)	(0.16)	(0.24)	(0.27)	(0.05)	(0.06)	(0.17)	(0.20)
high-skilled unemployed		-0.095		0.153*		-0.299		0.327		0.682**		-0.333
		(0.45)		(0.07)		(0.32)		(0.96)		(0.24)		(0.70)
long-term unemployed		-0.380**		-0.005		-0.261**		-0.619**		-0.055		-0.460**
		(0.12)		(0.02)		(0.09)		(0.23)		(0.05)		(0.17)
R^2 within	0.046	0.062	0.153	0.128	0.057	0.064	0.008	0.046	0.151	0.039	0.004	0.044
R^2 overall	0.288	0.363	0.661	0.687	0.230	0.307	0.267	0.346	0.653	0.601	0.218	0.294
R^2 between	0.315	0.399	0.686	0.714	0.252	0.339	0.300	0.389	0.678	0.631	0.250	0.336

Notes: robust or bootstrapped standard errors in parentheses. * significance at the 0.05 level, ** significance at the 0.01 level, *** significance at the 0.001 level.

Table 4: Effects of low skilled and long-term unemployment on start-up intensity – panel estimation and IV results

|	Random effects						Random effects IV					
	all start-ups		knowledge-intensive		low knowledge		all start-ups		knowledge-intensive		low knowledge	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
unemployment rate	-0.425*	-0.39	-0.167***	-0.229***	-0.213	-0.177	-0.089	-0.96	-0.213***	-0.276*	0.013	-0.711
	(-0.2)	(-0.28)	(-0.03)	(-0.05)	(-0.15)	(-0.2)	(-0.24)	(-0.6)	(-0.05)	(-0.11)	(-0.17)	(-0.39)
high-skilled unemployed		-0.061		-0.048*		-0.034		0.435		0.004		0.16
		(-0.1)		(-0.02)		(-0.07)		(-0.5)		(-0.09)		(-0.33)
long-term unemployed		-0.338*		0.029		-0.238*		-0.896*		0.016		-0.579
		(-0.14)		(-0.03)		(-0.11)		(-0.44)		(-0.07)		(-0.34)
R^2 within	0.046	0.064	0.153	0.155	0.057	0.061	0.008	0.085	0.151	0.234	0.004	0.08
R^2 overall	0.288	0.362	0.661	0.682	0.23	0.3	0.267	0.109	0.653	0.332	0.218	0.131
R^2 between	0.315	0.396	0.686	0.708	0.252	0.331	0.3	0.112	0.678	0.337	0.25	0.138

Notes: robust or bootstrapped standard errors in parentheses. * significance at the 0.05 level, ** significance at the 0.01 level, *** significance at the 0.001 level.

Figure 1: Unemployment rates by planning region

Unemployment rate 2001

> 0.000 - ≤ 0.070	(19)
> 0.070 - ≤ 0.091	(20)
> 0.091 - ≤ 0.119	(19)
> 0.119 - ≤ 0.190	(20)
> 0.190 - ≤ 1.000	(19)
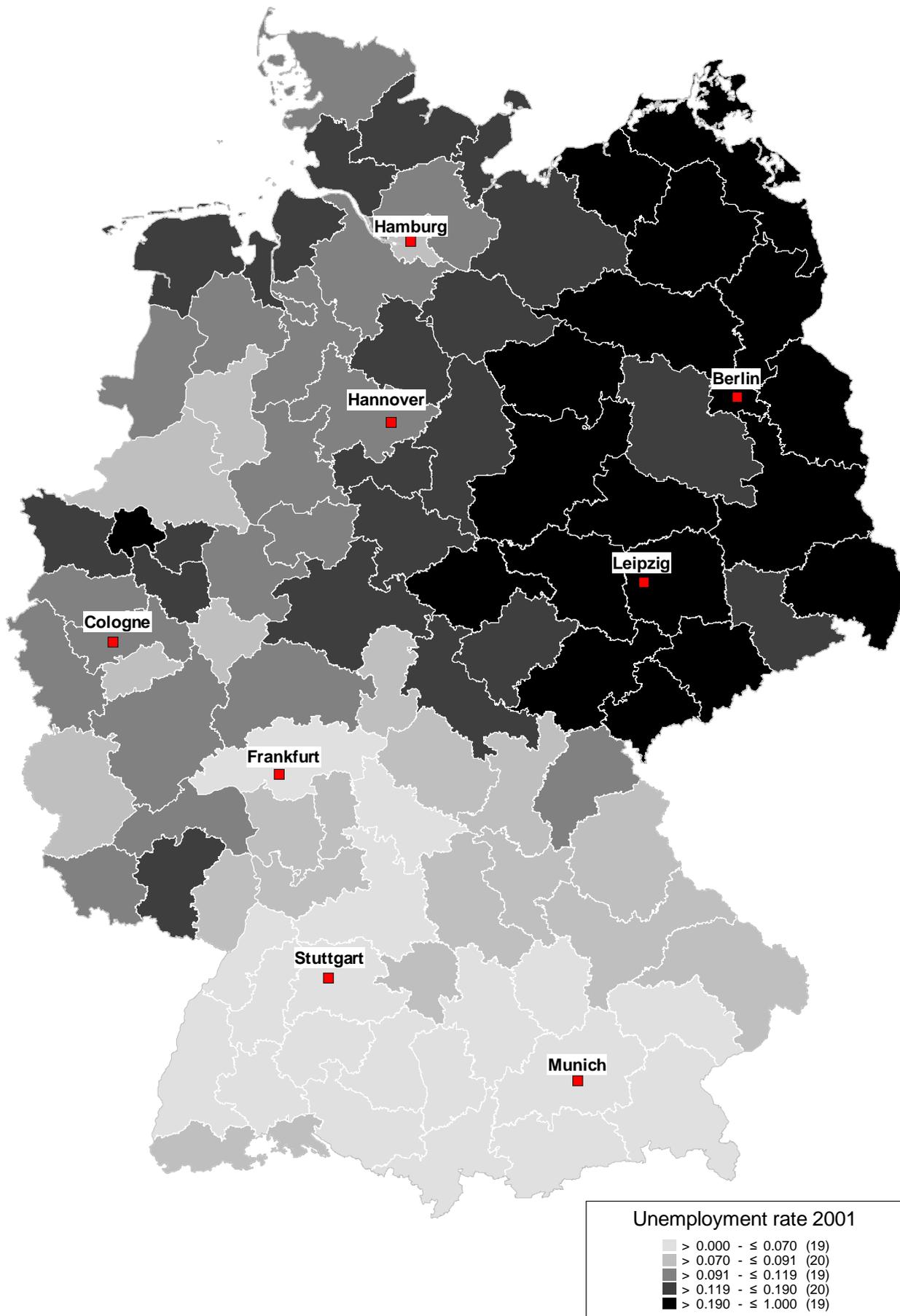
Figure 2: Shares of high skilled unemployed by planning region

Share of high-skilled unemployed 2001

> 0.000 - ≤ 0.027	(19)
> 0.027 - ≤ 0.036	(20)
> 0.036 - ≤ 0.043	(19)
> 0.043 - ≤ 0.059	(20)
> 0.059 - ≤ 1.000	(19)
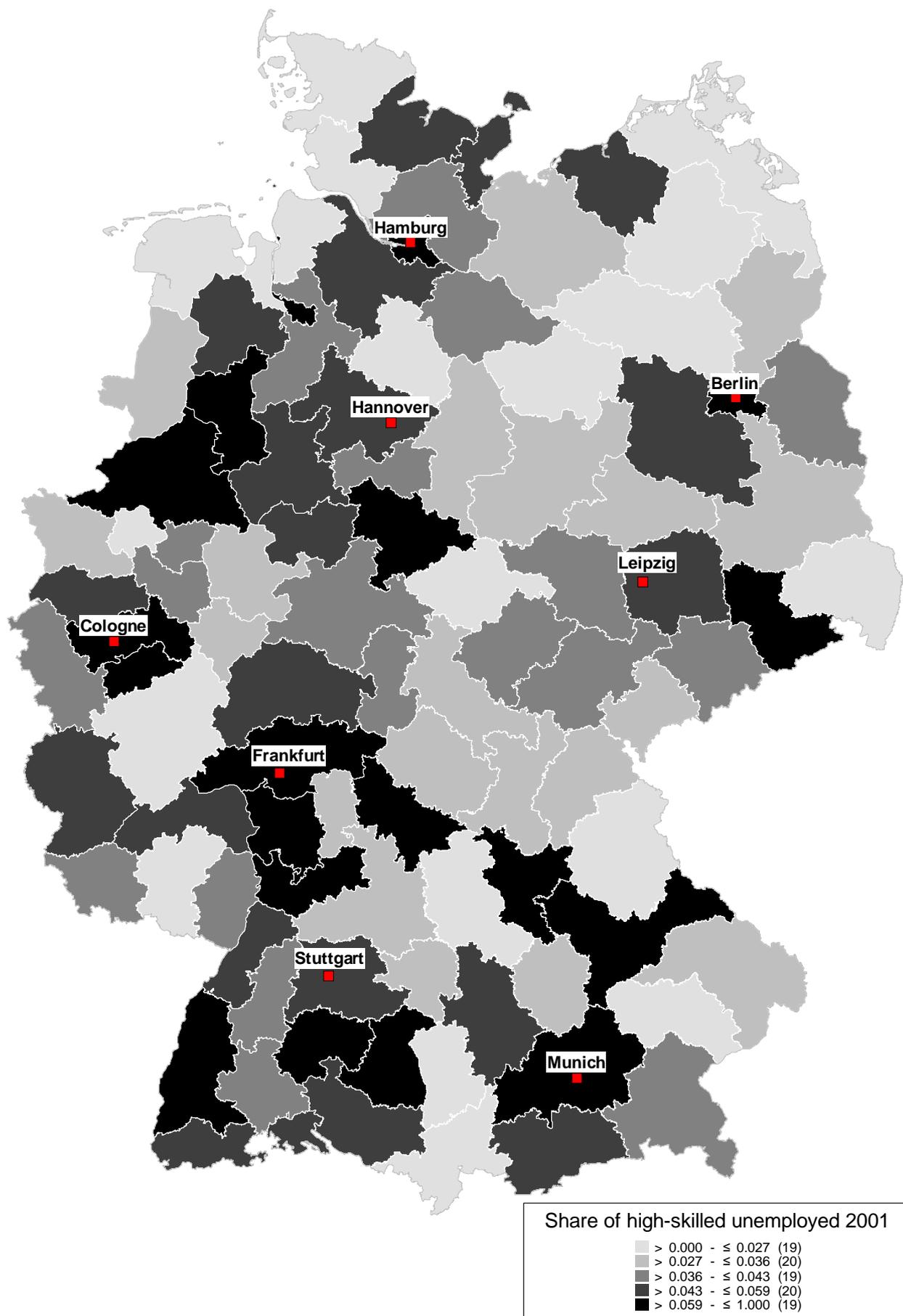
Figure 3: Shares of long-term unemployed by planning region

Share of long-term unemployed 2001

▓	> 0.000 - ≤ 0.289 (19)
▓	> 0.289 - ≤ 0.327 (20)
▓	> 0.327 - ≤ 0.346 (19)
▓	> 0.346 - ≤ 0.378 (20)
▓	> 0.378 - ≤ 1.000 (19)
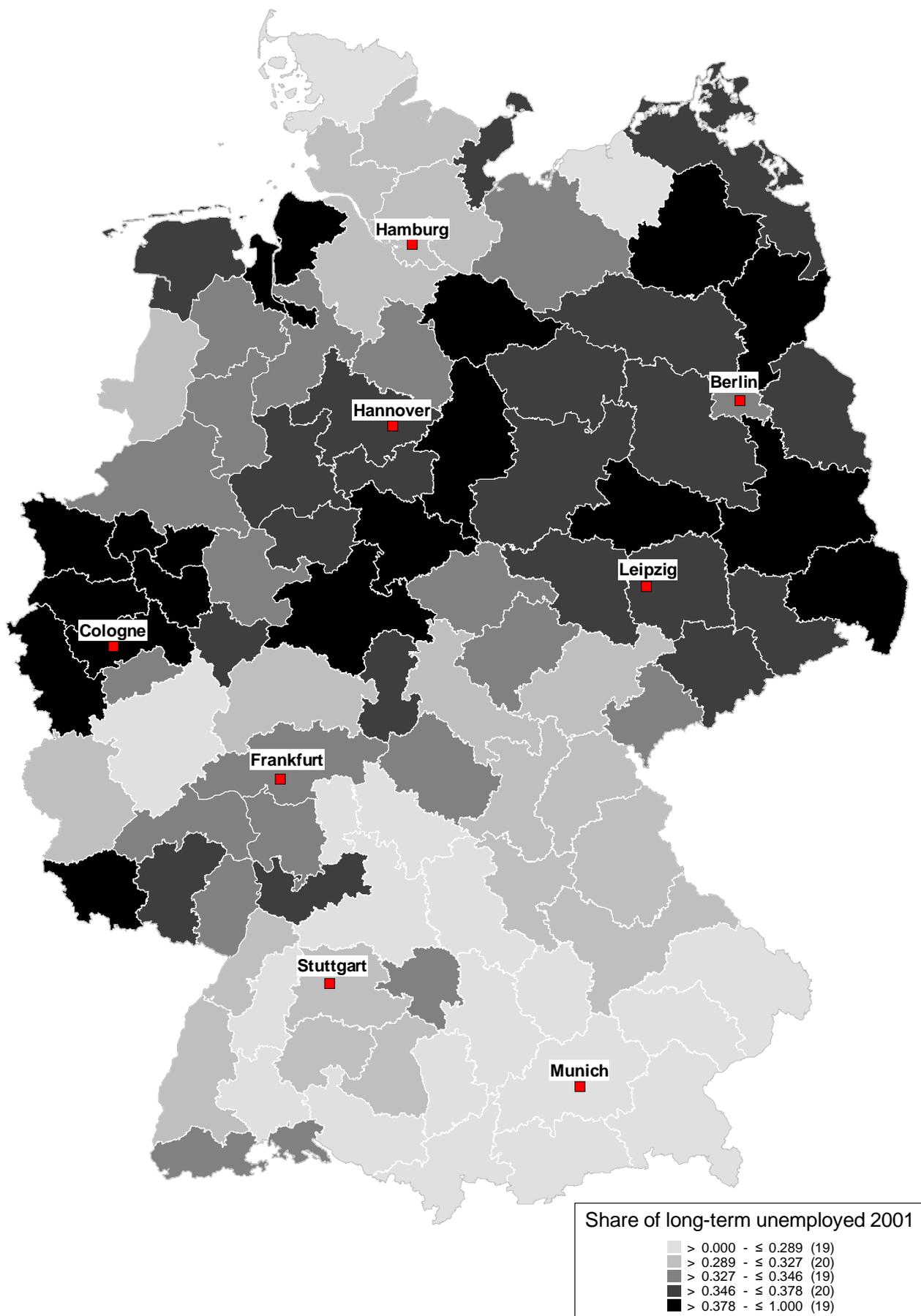
Appendix

Table A1: Summary statistics

	mean	standard deviation	minimum	maximum
total start-ups	43.67	7.44	25.42	68.72
knowledge intensive start-ups	5.53	2	2.24	17.82
low knowledge start-ups	31.49	5.23	19.41	45.17
unemployment rate	12.74	5.43	4.22	26.83
low-skilled unemployed	37.99	10.74	13.77	53.61
medium-skilled unemployed	57.49	11.44	40.23	82.93
high-skilled unemployed	4.52	2.03	1.34	12.76
long-term unemployed	35.63	5.36	18.6	49.14
income	134.74	109.85	29.59	575.8
W_income	142.89	58.02	44.02	325.26
income growth	2.31	0.85	-1.39	5.07
W_income growth	2.23	0.69	-0.57	3.88
research&development	6.35	1.58	3.2	11.05
small firms	30.07	4.2	20.37	41.73
large firms	18.01	6.81	4.61	34.59
manufacturing orientation	9.75	3.7	3.34	19.53
vacancy rate	0.02	0.01	0	0.08
net migration rate	-0.06	11.1	-83.85	20.62
cultural diversity	0.87	0.06	0.63	0.96
sectoral diversity	0.93	0.01	0.9	0.94

Table A2: Correlation analysis

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(1)	total start-ups	1																			
(2)	knowledge intensive start-ups	0.69	1																		
(3)	low knowledge start-ups	0.94	0.43	1																	
(4)	unemployment rate	-0.03	-0.44	0.18	1																
(5)	low-skilled unemployed	-0.04	0.32	-0.2	-0.71	1															
(6)	medium-skilled unemployed	-0.01	-0.41	0.18	0.72	-0.99	1														
(7)	high-skilled unemployed	0.26	0.6	0.06	-0.31	0.26	-0.42	1													
(8)	long-term unemployed	-0.19	-0.11	-0.15	0.36	0.23	-0.21	0	1												
(9)	income	0.36	0.63	0.18	-0.23	0.4	-0.45	0.44	0.16	1											
(10)	W_income	-0.04	0.14	-0.09	-0.31	0.43	-0.4	0	0.13	0.25	1										
(11)	income growth	0.01	0.04	-0.03	-0.28	-0.05	0.04	0	-0.46	-0.12	0.13	1									
(12)	W_income growth	-0.05	0.11	-0.13	-0.47	0.23	-0.24	0.12	-0.48	0.14	0	0.17	1								
(13)	research&development	0.22	0.66	-0.02	-0.46	0.48	-0.55	0.53	0.1	0.59	0.31	0.01	0.18	1							
(14)	small firms	-0.21	0.19	-0.39	-0.75	0.56	-0.54	0.1	-0.16	0.12	0.24	0.15	0.33	0.46	1						
(15)	large firms	-0.03	-0.38	0.14	0.26	-0.45	0.5	-0.45	-0.3	-0.56	-0.21	0.08	-0.09	-0.72	-0.42	1					
(16)	manufacturing orientation	0.15	0.53	-0.03	-0.37	0.54	-0.59	0.47	0.21	0.62	0.25	-0.14	0.16	0.76	0.36	-0.85	1				
(17)	vacancy rate	-0.13	0.07	-0.21	-0.48	0.24	-0.21	-0.10	-0.38	-0.05	0.15	0.18	0.35	0.06	0.49	-0.02	0.08	1			
(18)	net migration rate	0.18	0.13	0.17	-0.15	0.02	0.00	-0.13	-0.23	0.04	0.06	0.27	-0.01	0.01	0.02	0.16	-0.05	0.11	1		
(19)	cultural diversity	-0.05	-0.13	-0.01	0.19	-0.07	0.07	-0.03	0.22	-0.11	-0.07	-0.05	-0.12	-0.16	-0.25	0.06	-0.09	-0.11	-0.10	1	
(20)	sectoral diversity	-0.08	0.01	-0.14	-0.09	0.12	-0.13	0.08	-0.09	0.15	0.19	0.04	0.17	0.11	0.11	-0.10	0.11	0.06	-0.04	-0.25	1

Table A3: Between and within variation

		standard deviation	
	between	overall	within
total start-ups	7.44	7.08	2.36
knowledge intensive start-ups	2.00	1.96	0.42
low knowledge start-ups	5.23	4.94	1.76
unemployment rate	5.43	5.35	1.30
low-skilled unemployed	10.74	10.75	0.74
medium-skilled unemployed	11.44	11.44	0.80
high-skilled unemployed	2.03	2.03	0.24
long-term unemployed	5.36	4.42	3.04
income	109.85	109.80	8.77
W_income	58.02	57.63	7.95
income growth	0.85	0.62	0.59
W_income growth	0.69	0.51	0.46
research&development	1.58	1.58	0.17
small firms	4.20	4.17	0.58
large firms	6.81	6.77	0.88
manufacturing orientation	3.70	3.70	0.28
vacancy rate	0.01	0.01	0.01
net migration rate	11.10	10.88	2.33
cultural diversity	0.06	0.04	0.04
sectoral diversity	0.01	0.00	0.01