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Persistence and Change of Regional New Business Formation in the National League Table

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Abstract

The study investigates persistence and change of levels of regional entrepreneurial activity in West Germany over a period of thirty years. As indicated by previous studies, we generally find a rather high level of persistence. There are, however, also a number of regions that have changed their positions in the National League Table of entrepreneurship. We characterize these regions and attempt to explain the changes in the levels of entrepreneurship.

Jelcodes:R11,-

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Abstract

We investigate persistence and change of levels of regional entrepreneurial activity in West Germany over a period of thirty years. As indicated by previous studies, we generally find a rather high level of persistence. There are, however, also a number of regions that have changed their positions in the National League Table of entrepreneurship. We characterize these regions and attempt to explain the changes in the levels of entrepreneurship.

Keywords:	Entrepreneurship, new business formation, economic development, regional growth regimes
JEL classification:	L26, R11, O11

1. Persistence and change of regional new business formation

Empirical studies have shown that the regional levels of new business formation tend to be rather persistent over time.[1] Moreover, even if the overall level of new business formation in a country undergoes significant changes, the relative positions of regions within a country, in the National Entrepreneurship League Table (NELT), tends to be rather stable. The reasons for such high persistence of regional levels of entrepreneurship are still not very clear. One explanation could be that also the region-specific factors that influence entrepreneurial activity remain largely unchanged (Fotopoulos 2014). A second reason may be the presence of a regional entrepreneurship culture that affects the level of new business formation even if there are drastic changes of the socio-economic environment (Fritsch and Wyrwich 2014). Persistence of regional levels of entrepreneurship may have important implications for the prospects of policy strategies that build on increasing regional levels of new business formation in order to stimulate growth: In how far can such a policy succeed in the short and in the medium run? What are the appropriate starting points for such a policy?

This paper investigates persistence and changes of the relative position of West German regions with regard to new business formation over a period of thirty years, from 1976 up to 2007. We deal with three main research questions. First, how stable are the regional positions in the NELT? Second, what is the magnitude of occurring positional changes? Third, what are the reasons for a major rise and decline as compared to other regions? The challenge is to explain the changes of the positions in the NELT, especially, to identify those factors that have caused long term improvements of a region's relative position with regard to the level of new business formation.

Section 2 introduces data as well as the spatial framework of the analysis and gives an overview over regional new business formation in

[1] See Anderson and Koster (2011) for Sweden, Fotopoulos (2014) for the UK and Fritsch and Mueller (2007) and Fritsch and Wyrwich (2014) for Germany.

the period of analysis. We then analyze persistence and change in the ranking of regions (Section 3) and investigate the development of those regions that have experienced relatively pronounced changes of their relative positions (Section 4). This part of the analysis particularly tries to identify those factors that have caused these changes. The final section (Section 5) summarizes the results and concludes.

2. Data and spatial framework of analysis

Our data on new business formation is obtained from the Establishment History File of the German Social Insurance Statistics. This dataset contains every establishment in Germany that employs at least one person obliged to pay social insurance contributions (Spengler 2008). Since each establishment is assigned a unique identification number, new establishments can be identified by newly emerging numbers. Since the statistics has been introduced in the year 1975, the first year for which this information can be generated is 1976. For a more reliable identification of start-ups based on newly emerging establishing numbers we exploit a novel method that is based on workflow analyses (see Hethey and Schmieder 2010, for details). The start-up rate is the yearly number of new businesses in the private sector divided by the number of private-sector labor force (in thousands).

In order to reduce the effect of short-term fluctuations of the start-up rate between subsequent years we base our analysis on two year averages. Hence, the start-up rate at the beginning or our period of analysis is the average start-up rate for the years 1976/77. To control for the fact that the composition of industries not only varies considerably across regions but that the relative importance of new and incumbent businesses also varies systematically across industries, we calculate a sector-adjusted start-up rate. The sector-adjusted number of start-ups is defined as the number of new businesses in a region that would be expected if the composition of industries was identical across all regions. Thus, the measure adjusts the original data by imposing the same

composition of industries on each region (for details, see the Appendix of Audretsch and Fritsch 2002). While data on the establishment size distribution, qualification of workforce, R&D intensive manufacturing industry employment and sectoral structure are also obtained from the Social Insurance Statistics other information is from the Statistical Offices and from further sources.

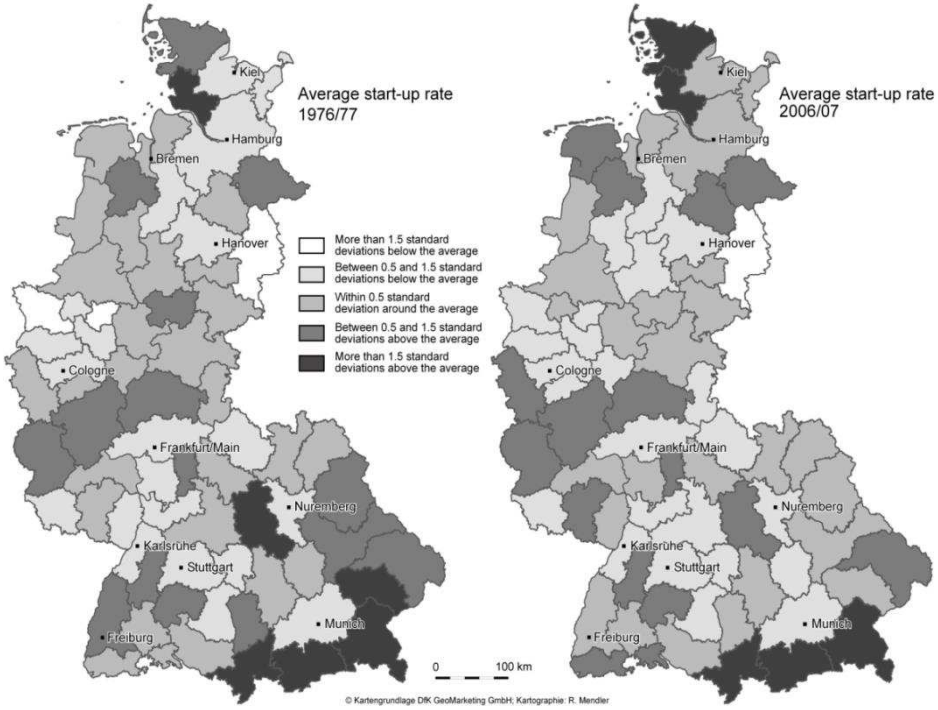

Figure 1: Regional distribution of start-up rates in West Germany 1976/77 and 2006/07

The spatial framework of our analysis are the 71 planning region[2] of West Germany[3], which represent functionally integrated spatial units

[2] We have also performed these analyses at the level of 326 West German districts where most of the results for planning regions are confirmed. Differences to the analyses at the level of planning regions pertain to the stability of rank positions at the top as compared to the bottom of the NELT. The results of these analyses at the district level are available from the authors upon request.

[3] We restrict our analysis to West Germany because many empirical studies indicate that the East German economy in the 1990s was a special case with very specific conditions that cannot be directly compared to those of West Germany (cf. Fritsch, 2004). There are actually 74 West German planning regions. For administrative reasons, the cities of Hamburg and Bremen are defined as planning regions even though they are not

comparable to labor market areas in the US. Figure 1 shows the spatial distribution of sector-adjusted start-up rates in West Germany at the beginning and at the end of our period of analysis, 1976/77 and 2006/07. A brief visual inspection of the two figures suggests that many of those regions that have been characterized by relatively high (low) start-up rates in the years 1976/77 also have relatively high (low) start-up rates thirty years later.

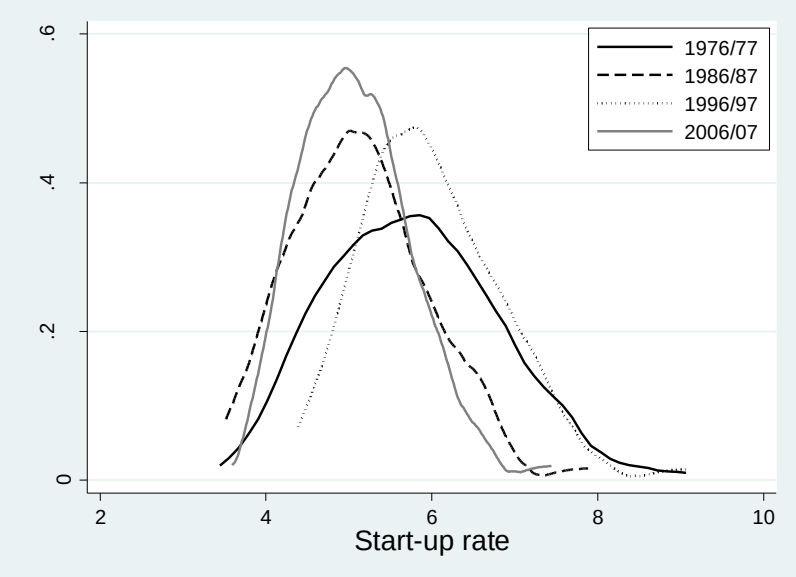

Figure 2: Distribution of regional start-up rates 1976/77, 1986/87, 1996/97 and 2006/07

The categories of sector-adjusted start-up rates in Figure 1 are based on the standard deviation distances from the mean values. When comparing the values for the 1976/77 period with those of 2006/07, 43 planning regions or 61 percent have retained their position within a same standard deviation distance from the mean start-up rate of the respective time period.

functional economic units. To avoid distortions, we merged these cities with adjacent planning regions. Hamburg has been merged with the region of Schleswig-Holstein South and Hamburg-Umland-South. Bremen has been merged with Bremen-Umland. Thus, the number of regions in our sample is 71.

The distribution of start-up rates across planning regions is close to the normal distribution but with a rather steep increase among the regions with low levels of new business formation and a more or less pronounced longer tail consisting of regions with relatively high start-up rates (Figure 2). Shifts of the distribution over time may reflect short-term fluctuations as well as long-term trends or changes in the statistical reporting system.[4] The mean and median values do not indicate any trend towards more start-ups and self-employment in Germany with regard to businesses with dependent employees (see Table A1 in the Appendix). This is consistent with other studies (e.g., Fritsch, Kritikos and Sorgner 2013) that show a rise of the number of business without any dependent employees (solo self-employment) that are not included in our data base but a constant level of self-employment with employees.

3. The National Entrepreneurship League Table of regions

Previous studies have revealed high levels of persistence in regional new business formation levels (Anderson and Koster 2011; Fotopoulos 2014; Fotopoulos and Storey 2015; Fritsch and Wyrwich 2014). Based on these findings we expect high stability also of the rank positions in the NELT. We start by estimating levels of persistence of start-up rates and stability in the rank positions over time (Section 3.1). In Section 3.2 we analyze the magnitude of occurring positional changes.

3.1 Stability of the regional positions in the Entrepreneurship League Table

To assess and analyze stability and changes of regional entrepreneurship activity, we take the rank positions of regions with regard to the level of new business formation. Rank positions have several advantages over start-up rates in capturing persistence for such a change phenomenon as a new business formation, especially if long time periods are analyzed.

[4] Such changes of the statistical reporting system occurred between the years 1997 and 1998 as well as between 2003 and 2004 when modifications of the industry classification scheme have been implemented.

One of these advantages is that rank positions are not shaped by national trends that affect all regions in the same way. Moreover, analyses of rank positions are far less influenced by extreme cases (‘outliers’) than an analysis based on start-up rates.

As an illustration, Figure 3 provides a comparison of rank positions with start-up rates for selected planning regions at different rank levels. It clearly demonstrates the effect of long term changing trends in start-up rates as well as concurrent strong persistence in positions relative to other regions.

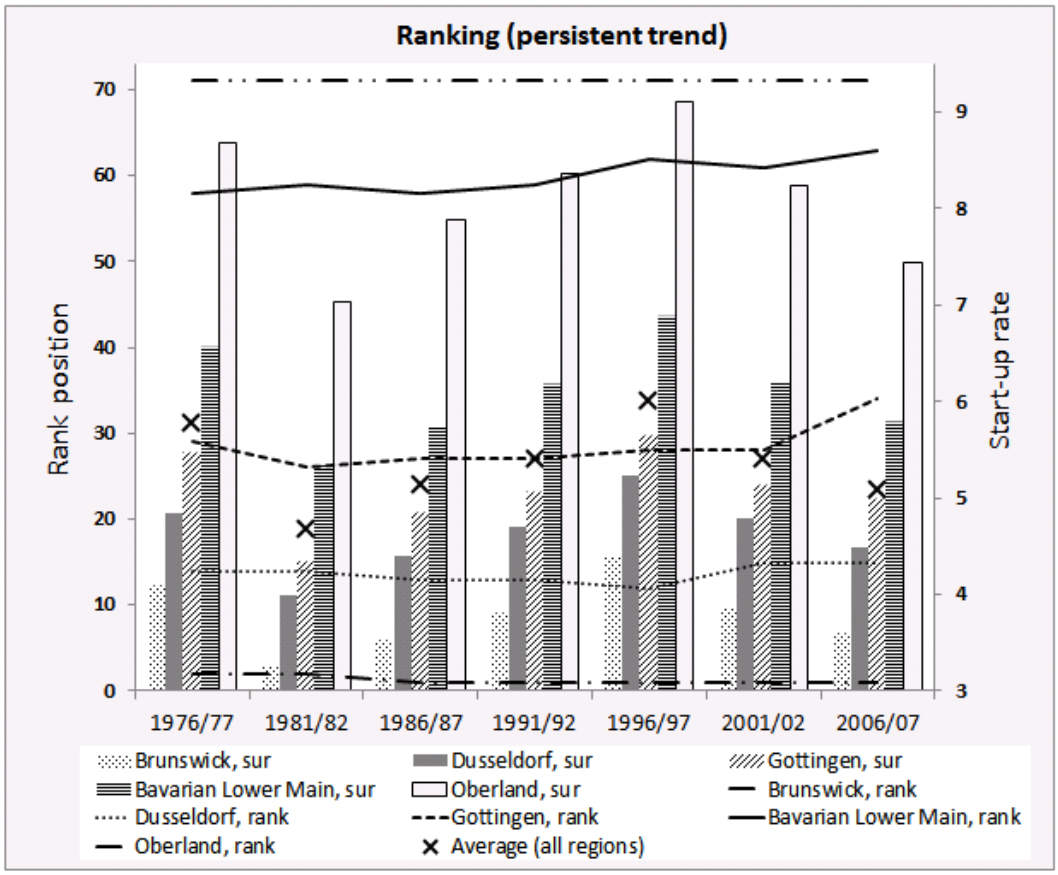

Figure 3: Comparison of rank positions with actual start-up rates (sur) for selected regions at different rank levels

There are rather high levels of correlation between the regional start-up rates for different years indicating a high degree of persistence of regional new business formation activity (Table 1). Although the statistical relationship between the start-up rates becomes weaker for more distant periods it is still strong and highly significant. These rather high values of

the correlation coefficients clearly suggest that regions with relatively high (low) start-up rates or rank positions in the period 1976/77 are very likely to have a correspondingly high (low) start-up rate and position in the NELT thirty years later.

Table 1: Correlations between regional start-up rates and ranks in different time periods

	1976/77	*1986/87*	*1996/97*	*2006/07*
1976/77	1	0.965*	0.919*	0.843*
1986/87	0.966*	1	0.950*	0.907*
1996/97	0.917*	0.936*	1	0.951*
2006/07	0.812*	0.867*	0.939*	1

Notes: Pearson correlation coefficients are shown in the upper right of the table while the lower left shows Spearman rank correlation coefficients. *: statistically significant at the 1 percent level.

Figure 4 illustrates the range of the variation of regional start-up rates and their level of persistence for time periods of ten years. In these graphs, the 45 degree line represents those regions that have identical start-up rates in different periods. Figure 5 shows similar comparisons over a thirty year time period. All figures reveal high levels of persistence of regional start-up rates and rank positions over a decade. While the changes of the start-up rates over a period of thirty years shows a slight decrease of new business formation activity for planning regions with an above average start-up rate in the initial period, the comparison of the rank positions over thirty years indicates a strong tendency to keep the same rank levels over long time period independent of the initial position. There are, however, quite a number of regions that change their rank positions over such a long period indicating a lower level of persistence as compared to a ten year period.

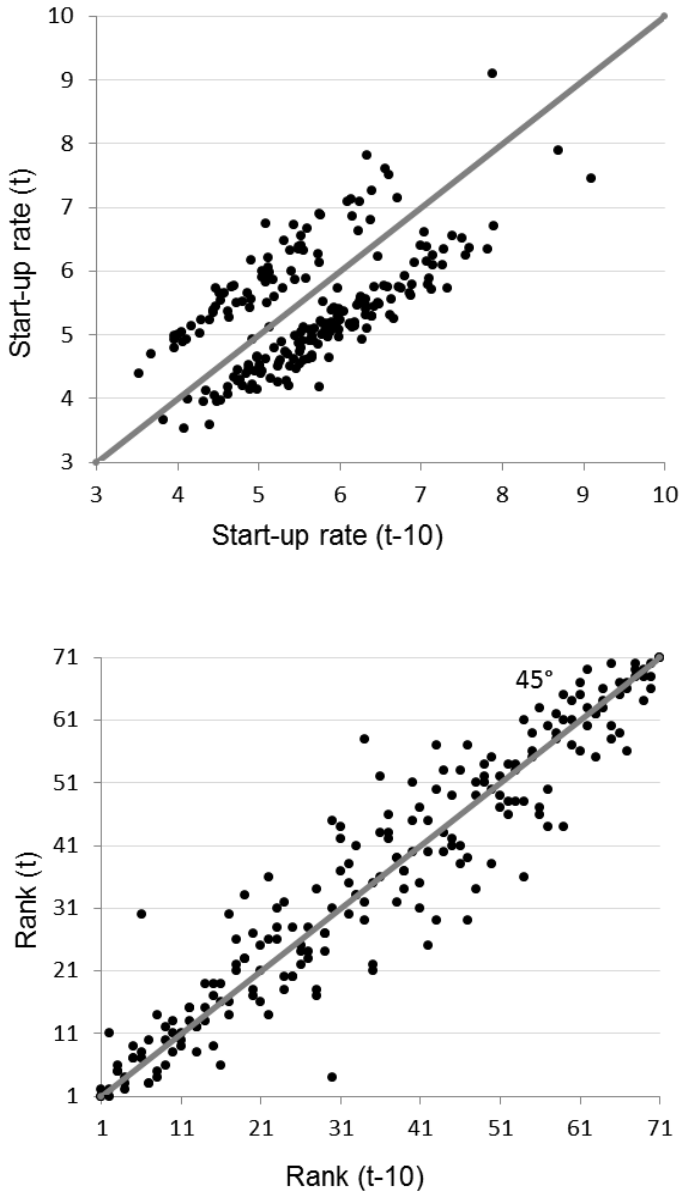

Figure 4: Relationship between start-up rates and ranks in period t and t-10[5]

[5] The split in the observations in the upper picture results from the changes in the reporting system in 2003/2004 when Social Insurance Statistics reports higher number of start-ups.

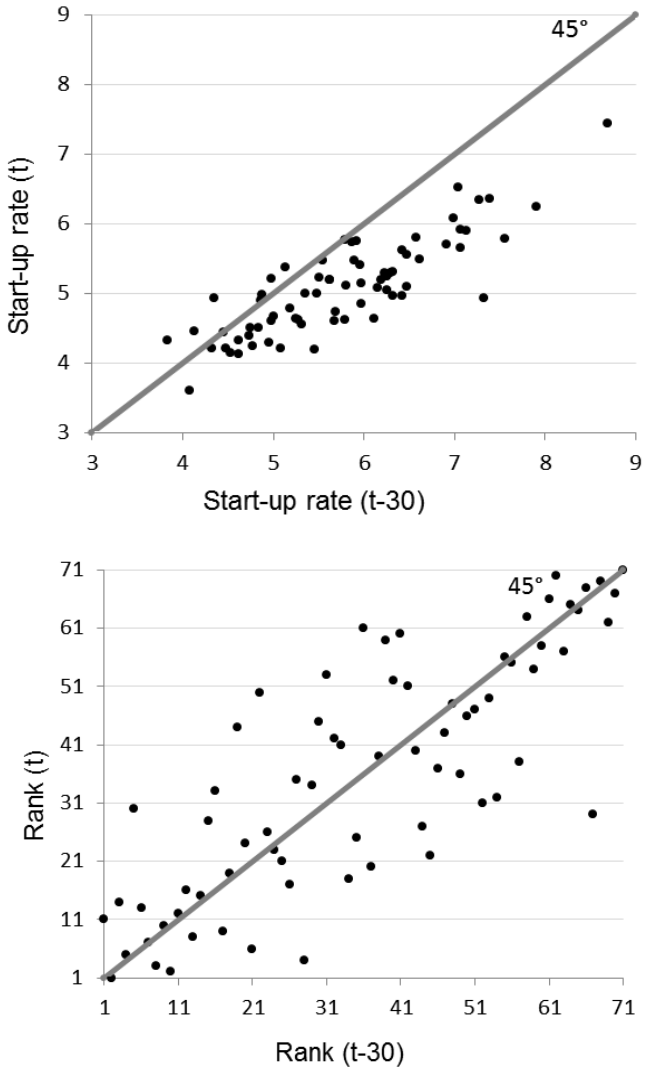

Figure 5: Relationship between start-up rates and ranks in period t and t-30

3.3 Magnitude of occurring positional changes in the National Entrepreneurship League Table

Figure 6 displays the distribution of the changes in the rank positions in the West German NELT that we observe between 1976/77 and 2006/07 (for the cumulative distribution function see Figure A2 in the Appendix). While 34 regions (about 48 percent of all regions) have not changed their rank by more than five positions, there are also quite a number of regions that climbed up or moved down the league table by more than 20 positions. The distribution of the rank changes is close to a normal distribution with a mean of zero change in the rank positions pointing to

the high probability in maintaining the same rank even over a period of thirty years. However the distribution possesses fat tail features due to those regions that have climbed up or moved down in the NELT by many positions. In the empirical analysis we pay particular attention to those regions that have experienced sharpest change in their NELT positions (see Section 4).

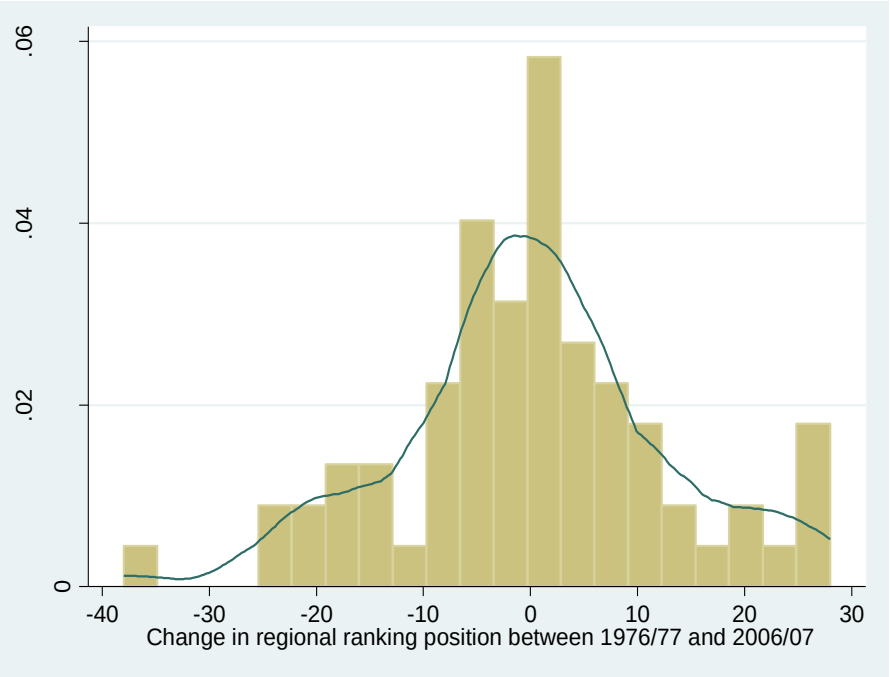

Figure 6: Distribution of changes in rank positions between 1976/77 and 2006/07

The spatial distribution of the rank changes in West Germany between 1976/77 and 2006/07 is displayed in Figure 7. We distinguish five categories of changes: “≈ 0” (-5 to 5 positions); “+” (6 to 15 positions); “++” (more than15 positions); “-“ (-6 to -15 positions); “--" (more than -15 positions).

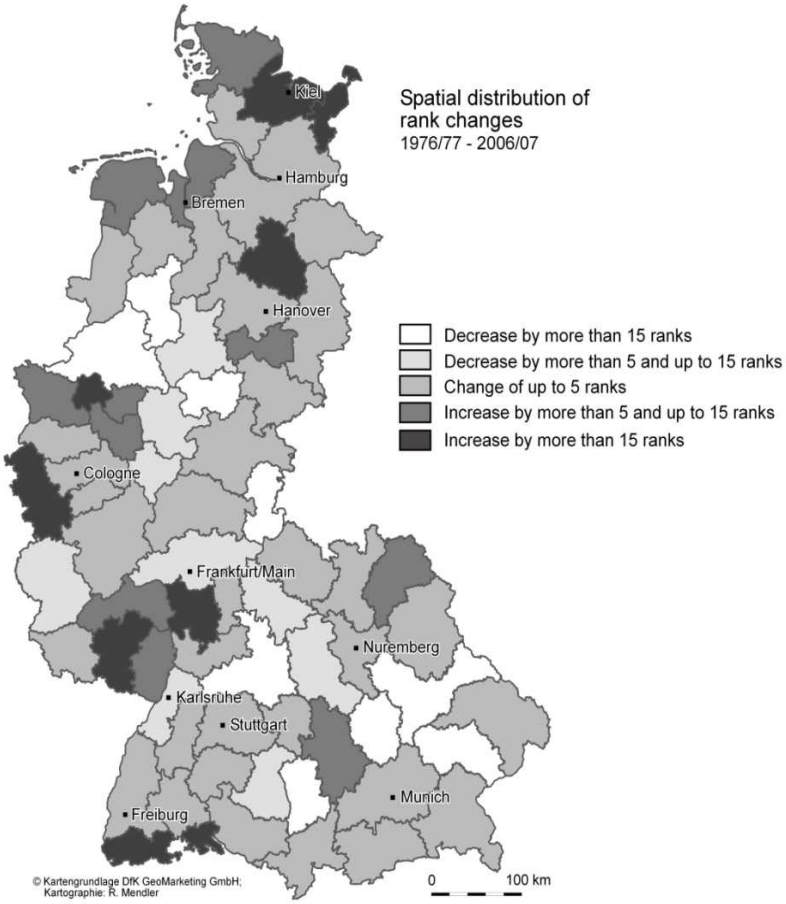

Figure 7: The spatial distribution of rank change in West Germany 1976/77 - 2006/07

This figure again illustrates the high level of stability in the rank positions over a thirty year period. That adjacent regions are often assigned to the same category of positional change suggesting the presence of neighborhood effects in the sense that many adjacent regions show the same tendency of persistence or change.

4. Changing places – who and why?

4.1 Hypotheses and indicators

While there are quite many empirical investigations into the determinants of regional levels of new business formation (see Fritsch and Storey 2014 for an overview) those factors that cause changes of these levels are largely unexplored. The very few analyses of the factors that lead to

changes of regional start-up rates (Fritsch and Mueller 2007; Fotopoulos 2014) suggest that many of the variables that influence the level of new business formation activity in a region also have an effect on the change of entrepreneurial activity. Fritsch and Mueller (2007) in an analysis for West Germany find a significantly positive effect of the share as well as of the changes in the number of R&D employees on an increase of new business formation activity. While such a positive effect was also identified for the share of employees in small and young firms as well as for labor productivity the effect of population density was significantly negative. They conclude that “the main factors that lead to an increase in start-up activity are regional innovativeness and the already existing level of entrepreneurship” (Fritsch and Mueller 2007, 310). Factors on the demand side of the regional economy such as regional GDP growth did not proof to be statistically significant.

Anderson and Koster (2011) and Fritsch and Wyrwich (2014) find that the level of persistence of regional start-up activity is particularly pronounced for regions with relatively high start-up rates. As an explanation for this result these authors argue that a regional culture of entrepreneurship requires a certain threshold level in order to be effective. This would imply that regions at the top of the NELT show higher levels of persistence than regions at the bottom. We analyze the magnitude of persistence at different level of entrepreneurial activity in Section 4.5.

Based on the results of previous studies we include the following variables into our analysis of the factors that might explain changing rank positions with regard to the level of new business formation (for an overview see Table 2).

- *Regional knowledge base*: According to the knowledge-spillover theory of entrepreneurship (Acs, Audretsch and Lehmann 2013) the size and the quality of the regional knowledge base can have a positive effect on the number of start-ups, particularly on the emergence of those start-ups that constitute a challenge for incumbent firms. Such challenging start-ups can be expected to contribute more to regional growth than

purely imitative start-ups (Fritsch 2013). This forms our expectation that a higher qualification level of the regional workforce can be related to a region's ability to hold or to increase its position in the NELT. We identify the regional knowledge base by the general qualification level of the workforce and measure it by the share of private sector employees having tertiary education over the total private sector employment.

- *Regional innovation potential*: We proxy regional innovation potential by the employment share in innovative manufacturing industries and expect higher levels of employment shares in innovative industries to be positively related to the probability of increasing in the rank position.
- *Regional industry structure*: To assess the effect of the regional industry structure, we apply several indicators that could capture industry structure and its change. First, one of the regional industry structure characteristics that can have an effect on knowledge exploitation through start-ups is minimum efficient size of the regional industries. Regions with high shares of industries with low minimum efficient size should also experience relatively high levels of new business formation (Fritsch and Falck 2007). Another reason why the presence of small scale industries should be conducive for new business formation is the relatively high propensity of small firm employees to start an own firm that is well documented by empirical research (Parker 2009; Elfenbein, Hamilton and Zenger 2010). Based on these findings, we expect high employment share in small businesses to be positively related to the probability of increase in the rank positions. Our measurement for the presence of small scale industries is the share of private sector employment in establishments with less than 20 employees over total private sector employment. In order to reduce the statistical relationship with the start-up rate that determines the rank position we exclude the employment in the start-ups of the current year.
- *Variety of the industry structure:* Another factor that may have an effect on regional performance is the concentration or variety of the industry structure. The empirical evidence in this respect is, however, rather

diverse. Boschma and Frenken (2011) argue that it is not industry variety per se but the related variety of similar or complementary industries that has positive effects. It has been shown that new businesses formation can make an important contribution to the emergence of such related variety (Neffke, Henning and Boschma 2011). We estimate the overall level of industry variety and expect it to be positively related to the probability of an increase of a region's rank position in the NELT. To assess regional industry diversity we adopt the methodology of Frenken, van Oort and Verburg (2007) by employing an entropy measure of regional industrial diversity according to Theil (1972). The measure can be constructed in a way that it varies between 0 and 1 where 0 would represent the presence of only one industry in the region and 1 would reflect a situation where all industries employ an equal number of employees.

- *Similarity of industry structure between entries and incumbents:* We also look to the structural change induced by entries. Noseleit (2013) compared the industry structure of entries with the industry structure of the incumbents as well as with the industry structure of those firms that exit. He finds that dissimilarity of these structures has a pronounced positive effect on regional development in West German regions. We follow the empirical approach of Noseleit (2013) and apply a measure of the level of similarity between the industry affiliation of start-ups and of incumbent firms. Since the number of employees in start-ups might not be an appropriate indicator for their economic significance, we relate the mere number of start-ups in the different industries to the number of incumbent employees in these industries. The similarity measure is calculated as a correlation coefficient between the number of employees in incumbent establishments and the number of entries in 28 two-digit industries. This correlation coefficient can assume values from -1 up to +1. A high level of correlation indicates a weak influence of entries on changes in the regional sectoral structure. In our data the similarity measure varies from 0.12 up to 0.76 for the base year pointing to rather pronounced differences across regions. We expect that

relative intense structural change as indicated by high levels of dissimilarity between the industry structures of entries and incumbents may not only have a positive effect on regional growth (Noseleit 2013) but can also create additional entrepreneurial opportunities that are conducive for start-ups and thus for a rise in the position in the entrepreneurial league table.

- *General regional conditions for entrepreneurship*: Regions with relatively high and increasing start-up rates might indicate to favorable conditions for entrepreneurship. This may include easy accessibility of inputs such as labor and finance as well as an entrepreneurial climate that is characterized by a positive attitude of the population towards self-employment (Kibler, Kautonen and Fink 2014; Westlund, Larsson and Olsson 2014) as well as a large number of entrepreneurial role models (Bosma, et al. 2012). Thus, we expect high share of self-employed persons especially in regions that have managed to increase their rank position. Due to the high correlation with share of small size establishments we include this indicator in the empirical model separately from share of small size establishments.

We also account for a number of control variables. Population density is used as a catch-all variable of various regional characteristics (e.g., housing and land prices, infrastructure availability etc.). To capture effects of different political conditions, we include dummies for the Federal State that a region belongs to. To control for the broad division of industry structure between the manufacturing and the service sector, we apply the share of employment in manufacturing. Since the change in the rank position might be to some extend determined by the initial position we control for the initial rank position at the outset of our period of analysis.

Table 2: Summary of indicators of independent variable included in the empirical analysis

Indicator	Measurement	Expected effect
Regional human capital	Share of employees with tertiary degree	"+"
Regional innovation potential	Share of employment in R&D intensive manufacturing	"+"
Small firm share	Share of employment in establishments with < 20 employees (excluding employment in start-ups)	"+"
Entrepreneurial culture	Self-employment rate	"+"
Regional industry diversity	Regional diversity index (according to Theil, 1972)	"+"
Related/unrelated diversity	Entropy measure of employment across industries (3 digit within 2 digit classification)	"?"
Industry similarity between entries and incumbents	Correlation between the industry structure of the start-ups and incumbents	"-"
Controls (Pop.density; Fed. States; Industry structure; Initial rank or top/bottom 20)	Population per km^2; dummies for federal state and top/bottom 20 ranks	

Notes: All explanatory variables are measured at the initial year of the analysis that is 1976.

An alternative way to control for the initial rank position are two dummy variables for belonging to the top 10 or bottom 10 positions. One idea behind these types of controls is that having a top (bottom) position limits the potential of moving further upwards (downwards). Moreover, the dummy for belonging to the top 10 positions can be regarded as a test for the idea that regions with high levels of entrepreneurship show a particularly pronounced level of persistence (Anderson and Koster 2011; Fritsch and Wyrwich 2014). We also tried out other definitions of top/bottom positions such as top/bottom 15 or 20 and found that the results are robust for these alternative definitions.

4.2 Bivariate analysis: t-tests of equal means

For the empirical analysis we distinguish three groups of regions according to the development of their rank positions over time. The first group that consists of 9 regions has climbed up by more than a standard

deviation from the mean change, i.e. 13 positions[6]. The second group that encompasses the great majority of regions (49 regions) remained within one standard deviation of their initial position and the third group (13 regions) declined by more than one standard deviation. Table 3 provides mean values of the regional characteristics for the different groups as well as the results of t-tests for differences between a particular group and the rest of the sample. Figures A4-A5 in the Appendix display the changes in the rank positions over time for these groups.

The results show that regions that have experienced an increase of their position by more than one standard deviation have been characterized by a large share of highly qualified workforce and of employment in innovative manufacturing industries in the base year (Table 3). These regions also had relatively high levels of population density and low shares of employment in the manufacturing sector. Correspondingly, regions with a decrease of the rank position by more than one standard deviation have relatively low shares of highly qualified workforce and employment in innovative manufacturing industries, high shares of manufacturing employment and low levels of population density. No clear difference between the three categories of regions can be found for the employment share in small businesses, the level of industry diversity, the levels of related and unrelated variety as well as for similarity of the industry structure between entries and incumbents.

Looking at the development of these characteristics during the period of analysis (Table 3), we find some tendencies of alignment with regard to these differences. For example, regions that declined in the league table have experienced the strongest increase of the share of highly qualified workforce relative to the initial level while those regions that moved up the league table showed the weakest improvement.

[6] The standard deviation is 12.94 and the mean value is zero.

Table 3: Characteristics of groups: Mean characteristics and t-test of equal means

Indicator	*Full sample*	*Decline by more than one standard deviation*	*Change within one standard deviation*	*Rise by more than one standard deviation*
Share of highly qualified workforce	0.030	0.023***	0.031**	0.032
Employment share in R&D intensive manufacturing industries	0.144	0.128	0.148	0.148
Employment share of small businesses	0.268	0.266	0.269	0.262
Self-employment rate	0.084	0.085	0.084	0.079*
Level of industry diversity	0.863	0.858	0.865	0.862
Related variety	1.360	1.330	1.381**	1.294*
Unrelated variety	4.362	4.320	4.382*	4.310
Similarity of industry structure between entries and incumbents	0.390	0.334**	0.411**	0.352
Share of manufacture employment	0.458	0.496**	0.452	0.430
Population density (log)	5.349	4.951***	5.412	5.578
Change in share of highly qualified workforce	0.058 *(197%)*	0.053* *(230%)*	0.060* *(194%)*	0.057 *(179%)*
Change in share of private sector R&D employment	-0.018 *(-12%)*	0.022 *(17%)*	-0.027***(-18%)*	-0.025 *(-17%)*
Change in employment share of small businesses	0.024 *(9%)*	0.001****(0.4%)*	0.024 *(9%)*	0.064*** *(24%)*
Change in self-employment rate	0.025 *(30%)*	0.013*** *(15%)*	0.026 *(31%)*	0.038*** *(48%)*
Change in level of industry diversity	-0.02 *(-2%)*	-0.013** *(-2%)*	-0.022 *(-3%)*	-0.020 *(-2%)*
Change in related variety	0.300 *(22%)*	0.288 *(22%)*	0.292 *(21%)*	0.357* *(28%)*
Change in unrelated variety	-0.004 *(-0.1%)*	0.037* *(0.9%)*	-0.014 *(-0.3%)*	-0.009 *(-0.2%)*
Change in similarity of industry structure between entries and incumbents	0.277 *(71%)*	0.258 *(77%)*	0.269 *(65%)*	0.350** *(99%)*
Change in share of manufacture employment	-0.117 *(-2%)*	-0.093* *(-2%)*	-0.118 *(-2%)*	-0.145** *(-3%)*
Change in population density (log)	0.112 *(24%)*	0.184** *(37%)*	0.100** *(22%)*	0.075* *(17%)*
Number of observations	71	13	49	9

Notes: Asterisks for each group indicate that the mean of the particular group is statistically different from the mean of the rest of the sample. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level. In parentheses- change relative to the initial value. Figures in the parenthesis show the percentage change.

A similar pattern can be found for the employment share in innovative manufacturing industries. Remarkably, all three types of regions show a decrease in the level of industry diversity that is also reflected in an increase of similarity between the industry structure between entries and incumbents. This increase of the similarity was most pronounced for those regions that experienced a change of their rank positions by more than one standard deviation. That these regions showed also the highest increase of employment in small businesses during the observation period is probably a result of the rising level of new business formation and the relatively pronounced decline of manufacturing employment. It is also quite remarkable that regions with a strong increase of their ranking position experienced the strongest decline of manufacturing employment despite the already relatively low share of manufacturing in the base year.

Those regions that remained within one standard deviation with regard to their position in the league table assume a middle position with regard to many of the characteristics. It is, however, noticeable that these regions have the highest level of industry diversity but also the highest values for our indicator of the similarity of the industry structure between entries and incumbents.

Such tests for differences of means provide a first impression about the characteristics of regions that have experienced a major rise or decline of the level of new business formation as compared to other regions. This picture may, however, be imprecise for at least two reasons. First, since we compare the regions with a certain level of change with the rest of the sample, the sample used for the comparison is not the same across different groups what makes interpretation difficult. Second, since the characteristics are related, multivariate analysis has to be performed.

4.3 Methodology and model specification

For the empirical analysis we distinguish the three categories of changes in the rank positions defined above: Increase of more than one standard deviation (= 3), change within one standard deviation (= 2) and decline by more than one standard deviation (= 1). Since this variable is of ordinal character, we apply ordered probit estimations to test the hypotheses developed in the Section 4.1.

The base model is specified as follows:

$$P(Yi^*|X_i) = \beta_0 + \beta_1 HC_i + \beta_2 RD_i + \beta_3 SMALLF_i + \beta_4 DIV_i + \beta_5 SIM_i + \beta_n x_{it} + \varepsilon_{it}$$

Where Y_i=
- 1 if $Y_i^* \leq$ minus one standard deviation change from the mean change in the rank position
- 2 if minus one standard deviation change from the mean change in the rank position < Y_i^* < one standard deviation change from the mean change in the rank position
- 3 if $Y_i^* \geq$ one standard deviation change from the mean change in the rank position

with

Y_i – indicator for a region *i* belonging to a particular category of the change in the rank positions;

HC_i – share of employees with tertiary degree;

RD_i – share of employment in R&D intensive manufacturing;

$SMALLF_i$ – share of employment in establishments with less than 20 employees excluding employment in start-ups of the current year (or- self-employment rate SER_i)

DIV_i – regional diversity index (or- related variety $RELV_i$ and unrelated variety $UNRELV_i$);

SIM_i – level of similarity between the industry structure of the start-ups and incumbents;

X_{it} – set of control variables (population density, Federal State dummies, initial rank position or control for top/bottom 20 positions);

ε_{it} – error term.

4.4. Results of multivariate analyses

Table 4 shows the results of ordered probit regressions explaining the probability to move from a declining through a persistent stage to an increasing rank position with initial regional characteristics as independent variables. In these models we use the initial rank position as a control variable; models with dummies for belonging to the top/bottom 10 positions show similar results (see Table A8). We do not include the indicator for the employment share in small businesses and the self-employment rate in the same model due to high correlation between these variables. We find a positive and in most cases statistically significant effect of private sector R&D employment for the likelihood to belong to the increasing rank position group indicating the importance of innovative activities for the emergence and the recognition of entrepreneurial opportunities. Diversity of the industry structure seems to be basically positive for an increase in a region's rank position indicating that it is the variety of entrepreneurial activity that leads to an increase of regional levels of entrepreneurship. Due to the high correlation of the different indicators for variety we test the effect of these indicators in separate models in order to avoid multicollinearity problems. While diversity being significant in nearly all model specifications, we do not find a significant effect neither for related nor unrelated variety (see Table A8 in the Appendix).

All model specifications reveal significant and negative effect for the level of the similarity of industry structure between entries and incumbents indicating that higher dissimilarity has a positive effect on the probability of an increased rank position. This is an indication that the change in the industry structure induced by entries plays a significant role in the increase of entrepreneurial activity in the region. A high share of manufacturing employment in the base year is not conducive for increasing the position in the entrepreneurial league table. When combined with results for the employment share in innovative manufacturing industries, this tells that it is innovative manufacturing and not manufacturing per se, that leads to higher entrepreneurial activity at the regional level. The regressions do not

reveal any significant effect of the share of highly qualified workforce even though descriptive evidence revealed highest shares of highly qualified workforce for the group of regions that have raised most. An explanation could be that higher qualification leads to the creation of more successful ventures rather than more in magnitude. One out of two models where we test the role of general regional conditions for entrepreneurship reveals a positive and significant role of such conditions on the probability of rise in rank position what is in line with our expectations. Our control for population density shows significant and positive effect of densely populated regions to belong to the increasing rank position group.

Table 4: Determinants of change in rank positions

Indicator	Model I	Model II	Model III
Share of highly qualified workforce	0.05	-2.10	-1.41
	(4.38)	(4.47)	(4.49)
Employment share in R&D intensive manufacturing	1.14	1.41*	1.57**
	(0.77)	(0.77)	(0.77)
Employment share of small businesses	4.32**		
	(2.04)		
Level of entrepreneurial culture (self-employment rate)		7.37	
		(6.33)	
Level of industry diversity	2.56*	2.47*	2.74*
	(1.30)	(1.37)	(1.37)
Similarity of industry structure between entries and incumbents	-0.93**	-1.03**	-1.02**
	(0.41)	(0.42)	(0.42)
Share of manufacture employment	0.1	-1.17*	-1.47**
	(0.96)	(0.69)	(0.65)
Population density (log)	0.37***	0.37***	0.36***
	(0.11)	(0.11)	(0.11)
Rank (initial position)	0.00	0.00	0.00
	(0.01)	(0.01)	0.00
Federal State dummies	Yes*	Yes	Yes*
Number of observations	71	71	71
Log likelihood	-39.41	-40.96	-41.65
Chi2	38.85	35.75	34.37
Variance inflation factor (vif)	5.18	4.75	3.76

Notes: Marginal effects reported; Dependent variable: Change in rank positions (3 groups); Ordered probit regression; Standard errors in parentheses; ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

Altogether the empirical results to a large extend confirm our expectations and show that initial regional characteristic can play a significant role for explaining development trajectories of regions even in such long time periods as thirty years. The mean variance inflation factor for all model specification varies from 3.08 up to 5.18[7] .

4.5. Results for the strength of persistence at different rank levels

We apply several approaches to assess the level of persistence at different rank positions. In a first step we compare the ten regions at the top of the NELT with the ten regions at the bottom at the beginning and at the end of our period of analysis (see Table 5). Nine planning regions have kept their position in the top ten whereas six regions of the bottom ten are still in the group at the end of the period. This indicates a higher level of persistence among those regions that have a relatively high level of new business formation.

[7] The level of multicollinearity is particularly driven by the inclusion of the initial rank position. If the initial rank position is omitted, the value of the vif is 3.7 and results for other variables do not show any remarkable changes.

Table 5: League table positions for planning regions at the beginning and end of the analysis

Name of region	Rank (1976/77)	Rank (2006/07)	Number of regions that kept positions within the bottom/top 10
Oberland	71	71	9
Schleswig-Holstein South-West	70	67	
Western Central Franconia	69	63	
Southeast Upper Bavaria	68	69	
Allgaeu	67	68	
Landshut	66	29	
Schleswig-Holstein North	65	70	
Danube-Forest	64	64	
Middle Rhine-Westerwald	63	66	
Luneburg	62	65	
Lower Neckar	10	9	6
Rhine-Main	9	2	
Industrial Region Central Franconia	8	6	
Bochum/Hagen	7	14	
Stuttgart	6	5	
Emscher-Lippe	5	31	
Cologne	4	7	
Duisburg/Essen	3	15	
Brunswick	2	1	
Dortmund	1	11	

Notes: The top position is denoted by rank 71, accordingly, the bottom position is rank 1. Regions in italics kept their position within the top/bottom 10 at the beginning as well as at the end of period of analysis

In a second step we calculate correlations between the rank position at the beginning and at the end of time period for relatively high and low positions in the League table in the base year (see Table 5, Columns 2-3). Relatively high (top) rank positions reveal higher correlation coefficients between initial and final rank positions suggesting higher levels of persistence at the top of the NELT. Remarkably, the difference between the values of the correlation coefficients increases when more extreme ranges (top/bottom 25; top/bottom 20) are considered.

Table 6: Strength of regional persistence at different rank levels

Sample	Correlation (rank positions in 2006/07 and 1976/77)	Difference in correlations (top minus bottom positions in absolute values)	Coefficient (regressing rank 2006/07 on 1976/77; OLS)	R^2	Number of obser-vations
I	II	III	IV	V	VI
Full sample	0.80	-	0.80***	0.65	71
Top half (from position 36 upwards)	0.51	-0.08	0.72***	0.26	36
Bottom half (up to position 35)	0.59		0.86***	0.35	35
Top 25 positions	0.70	0.16	1.39***	0.49	25
Bottom 25 positions	0.54		0.95***	0.29	25
Top 20 positions	0.64	0.24	1.56***	0.41	20
Bottom 20 positions	0.40		0.80*	0.16	20
Top 10 positions	0.20	0.07	0.7	0.04	10
Bottom 10 positions	-0.13		-0.37	0.02	10

Notes: ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

As a final step we regress the final rank position in 2007/06 on the initial position in 1977/76. Regression coefficients, R^2 values and numbers of observations are reported in column 4-6 in Table 5). If the coefficient in the regression results would assume a value of “1” this would mean that the regions have kept their initial rank position at the end of the observation period in 2006/07. However, if the regression coefficient is considerably larger (smaller) than “1” it shows tendency for regions to increase (decrease) in the final rank position at the end of the observation period in 2006/07 when compared to the initial rank position. From the regression results we see that the effect of the rank position in the initial period is stronger for relatively high positions in the NELP. However, regression coefficients do not indicate that higher rank positions would

have a higher tendency to keep the initial rank positions at the end of the period of analysis.

All in all, the results of the comparison of League Table positions, correlation between the rank position at the beginning and the end of time period, comparison of initial and final average rank value indicates that planning regions at the top of the NELP show higher levels of persistence than regions at the bottom. We do, however, not get full support for such a pattern from the regression analyses.

5. Conclusions

We investigated persistence and changes of the rank positions of West German regions with regard to new business formation over a period of thirty years. Our analysis confirms previous studies that have found high levels of persistence over time for most regions but we also observe a number of significant changes in the National Entrepreneurship League Table (NELT). Multivariate analyses showed a number of characteristics of regions that experienced a considerable increase of their relative levels of new business formation activities and those with rather persistent and declining rank positions. In particular, regions that experienced a strong increase of their levels of new business formation have been characterized by a relatively low share of manufacturing employment and high diversity of their industry structure in the base year. Moreover, these regions had relatively low levels of similarity of the industry structure between entries and incumbent businesses that should have led to even more variety of the industry structure. Nevertheless, significant changes in the regional level of new business formation tend to emerge over only over a longer time period and are in the majority of cases of a small magnitude. Therefore, policies aiming at stimulating regional levels of entrepreneurship may not be able to cause larger changes of the regional start-up rated but need a long-term orientation.

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Tables and Figures

Table A1: Descriptive statistics of two year averaged sector adjusted start-up rates

Year	*Number of observations*	*Mean*	*Median*	*Standard Deviation*	*Minimum*	*Maximum*	*Skewness*
1976/77	71	5.772	5.792	1.001	3.827	8.684	0.375
1986/87	71	5.133	5.109	0.829	3.519	7.887	0.533
1996/97	71	6.005	5.876	0.846	4.387	9.098	0.821
2006/07	71	5.085	5.042	0.683	3.593	7.444	0.647

Figure A2: Cumulative distribution function of changes in rank positions between 1976/77 and 2006/07 (planning region level)

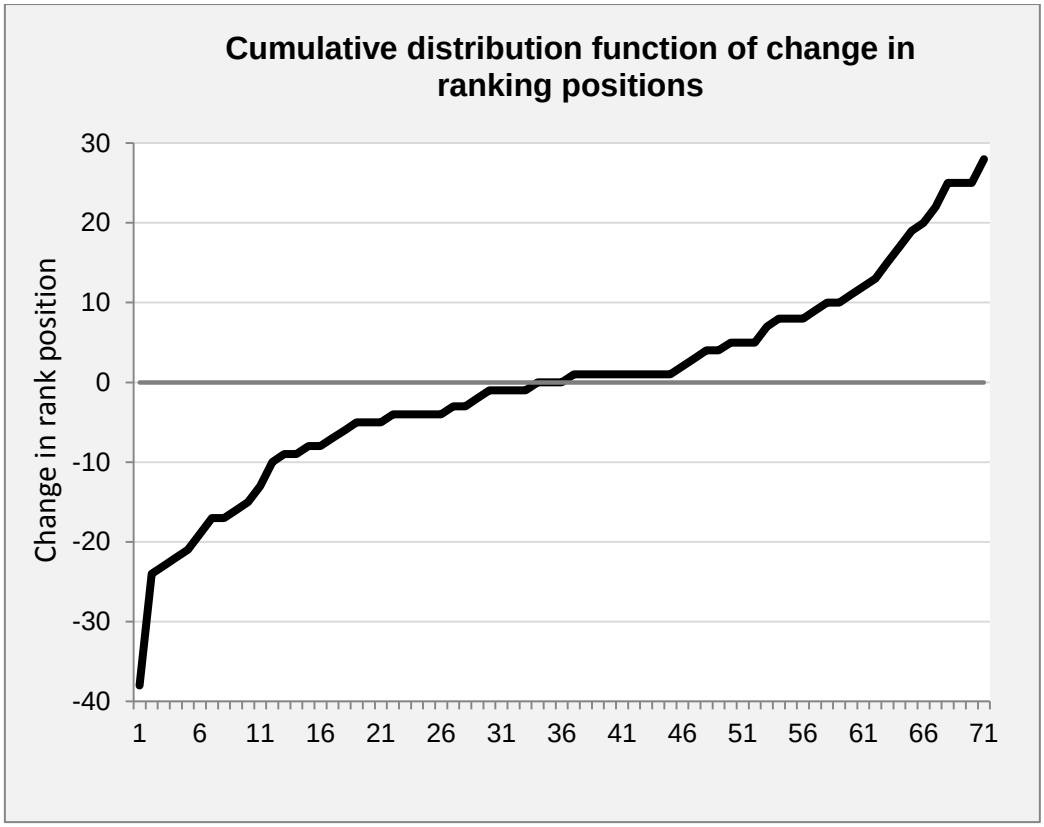

Table A3: Descriptive statistics for three groups (decreasing; persistent; increasing)

Group 1 (Declining)

Indicator	*Number of observations*	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
Share of highly qualified workforce	13	0.02	0.01	0.02	0.04
Employment share in R&D intensive manufacturing	13	0.13	0.04	0.05	0.20
Employment share of small businesses	13	0.27	0.03	0.21	0.31
Self-employment rate	13	0.08	0.01	0.07	0.10
Level of industry diversity	13	0.86	0.03	0.80	0.89
Related variety	13	1.33	0.17	0.96	1.59
Unrelated variety	13	4.32	0.13	4.02	4.50
Similarity of industry structure between entries and incumbents	13	0.33	0.12	0.14	0.54
Share of manufacture employment	13	0.50	0.06	0.40	0.58
Population density (log)	13	4.95	0.29	4.51	5.42
Change in share of highly qualified workforce	13	0.05	0.01	0.03	0.08
Change in share of private sector R&D employment	13	0.02	0.06	-0.04	0.17
Change in employment share of small businesses	13	0.00	0.01	-0.02	0.02
Change in self-employment rate	13	0.01	0.00	0.01	0.02
Change in level of industry diversity	13	-0.01	0.01	-0.03	0.01
Change in related variety	13	0.29	0.10	0.13	0.45
Change in unrelated variety	13	0.04	0.10	-0.15	0.22
Change in similarity of industry structure between entries and incumbents	13	0.26	0.12	0.11	0.46
Change in share of manufacture employment	13	-0.09	0.03	-0.14	-0.01
Change in population density (log)	13	0.18	0.08	0.05	0.31

Group 2 (Persistent)

Indicator	*Number of observations*	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
Share of highly qualified workforce	49	0.03	0.01	0.01	0.08
Employment share in R&D intensive manufacturing	49	0.15	0.07	0.04	0.38
Employment share of small businesses	49	0.27	0.06	0.19	0.43
Self-employment rate	49	0.08	0.02	0.06	0.14

Level of industry diversity	49	0.87	0.03	0.78	0.91
Related variety	49	1.38	0.13	1.04	1.67
Unrelated variety	49	4.38	0.18	3.72	4.67
Similarity of industry structure between entries and incumbents	49	0.41	0.15	0.13	0.76
Share of manufacture employment	49	0.45	0.10	0.23	0.65
Population density (log)	49	5.41	0.72	4.23	7.11
Change in share of highly qualified workforce	49	0.06	0.02	0.03	0.12
Change in share of private sector R&D employment	49	-0.03	0.05	-0.18	0.15
Change in employment share of small businesses	49	0.02	0.02	-0.02	0.07
Change in self-employment rate	49	0.03	0.01	0.01	0.04
Change in level of industry diversity	49	-0.02	0.03	-0.10	0.05
Change in related variety	49	0.29	0.10	0.07	0.57
Change in unrelated variety	49	-0.01	0.17	-0.28	0.44
Change in similarity of industry structure between entries and incumbents	49	0.27	0.10	0.04	0.45
Change in share of manufacture employment	49	-0.12	0.04	-0.21	-0.02
Change in population density (log)	49	0.10	0.08	-0.06	0.27

Group 3 (Increasing)

Indicator	*Number of observations*	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
Share of highly qualified workforce	9	0.03	0.01	0.02	0.05
Employment share in R&D intensive manufacturing	9	0.15	0.06	0.09	0.29
Employment share of small businesses	9	0.26	0.04	0.21	0.33
Self-employment rate	9	0.08	0.01	0.06	0.09
Level of industry diversity	9	0.86	0.03	0.82	0.91
Related variety	9	1.29	0.12	1.12	1.50
Unrelated variety	9	4.31	0.16	4.08	4.55
Similarity of industry structure between entries and incumbents	9	0.35	0.16	0.12	0.61
Share of manufacture employment	9	0.43	0.10	0.31	0.56
Population density (log)	9	5.58	0.69	4.44	7.00
Change in share of highly qualified workforce	9	0.06	0.02	0.04	0.09
Change in share of private sector R&D employment	9	-0.03	0.03	-0.09	0.03

Change in employment share of small businesses	9	0.06	0.01	0.05	0.08
Change in self-employment rate	9	0.04	0.00	0.03	0.04
Change in level of industry diversity	9	-0.02	0.03	-0.06	0.04
Change in related variety	9	0.36	0.12	0.11	0.56
Change in unrelated variety	9	-0.01	0.14	-0.25	0.20
Change in similarity of industry structure between entries and incumbents	9	0.35	0.13	0.12	0.55
Change in share of manufacture employment	9	-0.14	0.04	-0.23	-0.10
Change in population density (log)	9	0.08	0.07	-0.03	0.17

Figure A4: Rank changes over time for increasing rank change group (Sample: Increase more than one standard deviation over thirty years)

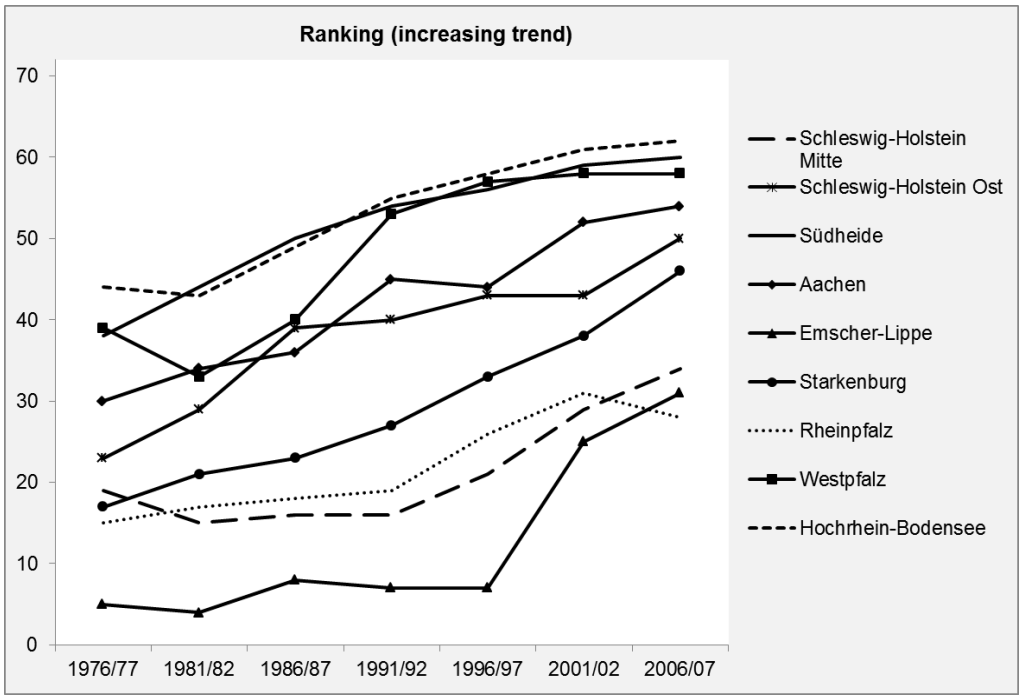

Figure A5: Rank changes over time for decreasing rank change group (Sample: Decrease more than one standard deviation over thirty years)

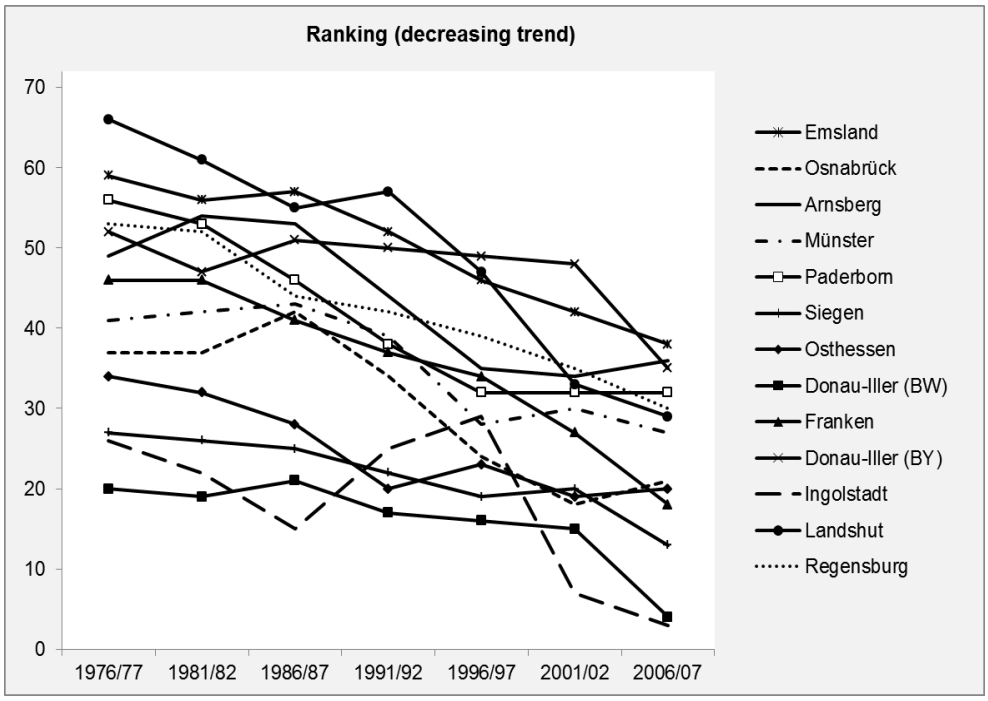

Table A6: Correlation matrix (planning region level)

	Indicator	I	II	III	IV	V	VI	VII	VIII	IX	X
I	Share of highly qualified workforce	1.00									
II	Employment share in R&D intensive manufacturing	0.26	1.00								
III	Employment share of small businesses	-0.49	-0.52	1.00							
IV	Self-employment rate	-0.54	-0.38	0.93	1.00						
V	Level of industry diversity	0.18	-0.28	0.19	0.20	1.00					
VI	Related variety	0.30	0.07	-0.17	-0.19	0.20	1.00				
VII	Unrelated variety	0.45	-0.09	-0.07	-0.04	0.72	0.40	1.00			
VIII	Similarity of industry structure between entries and incumbents	0.29	-0.50	0.36	0.21	0.43	0.31	0.48	1.00		
IX	Share of manufacture employment	-0.19	0.61	-0.50	-0.25	-0.26	0.02	-0.18	-0.76	1.00	
X	Population density (log)	0.66	0.20	-0.63	-0.73	0.02	0.39	0.24	0.15	-0.04	1.00

Table A7: Determinants of change in rank positions

Indicator	Model I	Model II	Model III
Share of highly qualified workforce	0.37	-2.25	-3.19
	(4.52)	(4.30)	(4.28)
Employment share in R&D intensive manufacturing	1.31*	1.39*	1.37*
	(0.75)	(0.76)	(0.78)
Employment share of small businesses	3.83*		
	(1.68)		
Level of entrepreneurial culture (self-employment rate)		6.6	
		(5.05)	
Level of industry diversity	2.49*	2.26	2.39
	(1.38)	(1.40)	(1.40)
Similarity of industry structure between entries and incumbents	-1.06**	-1.08**	-0.97**
	(0.41)	(0.42)	(0.41)
Share of manufacture employment	-0.38	-1.33*	-1.54**
	(0.86)	(0.68)	(0.67)
Population density (log)	0.43***	0.42***	0.36***
	(0.12)	(0.12)	(0.11)
Dummy (bottom 10 positions)	-0.05	-0.11	-0.17
	(0.14)	(0.14)	(0.14)
Dummy (top 10 positions)	-0.05	-0.01	0.13
	(0.14)	(0.14)	(0.11)
Federal State dummies	Yes*	Yes*	Yes
Number of observations	71	71	71
Log likelihood	-39.46	-40.64	-42.16
Chi2	38.74	36.39	33.34
Variance inflation factor (vif)	4.12	3.79	3.37

Notes: Marginal effects reported; Dependent variable: Change in rank positions (3 groups); Ordered probit regression; Standard errors in parentheses; ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

Table A8: Determinants of change in rank positions

Indicator	Model I	Model II	Model III
Share of highly qualified workforce	0.84	1.43	-0.44
	(4.71)	(4.80)	(4.84)
Employment share in R&D intensive manufacturing	0.90	1.13	1.30
	(0.79)	(0.79)	(0.80)
Employment share of small businesses	4.65**		
	(2.11)		
Level of entrepreneurial culture (self-employment rate)		9.4	
		(6.50)	
Related variety	0.03	0.06	0.05
	(0.30)	(0.31)	(0.32)
Unrelated variety	0.14	0.09	0.09
	(0.26)	(0.27)	(0.27)
Similarity of industry structure between entries and incumbents	-0.78	-0.89*	-0.83*
	(0.48)	(0.49)	(0.49)
Share of manufacture employment	0.18	1.1	-1.47**
	(0.99)	(0.72)	(0.69)
Population density (log)	0.35***	0.35***	0.34***
	(0.11)	(0.11)	(0.11)
Rank (initial position)	0.00	0.00	0.00
	(0.01)	(0.01)	0.00
Federal State dummies	Yes	Yes	Yes
Number of observations	71	71	71
Log likelihood	-41.1	-42.45	-43.5
Chi2	35.46	32.76	30.67

Notes: Marginal effects reported; Dependent variable: Change in rank positions (3 groups); Ordered probit regression; Standard errors in parentheses; ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.