Entrepreneurship, Structural Change, and Economic Growth

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Abstract

The ability to adjust to structural change is vital to economic development, and entries can be active participants in this process. While the importance of factor reallocations for growth is widely accepted, the role of entrepreneurs in managing these reallocations is rarely, if ever, mentioned in the empirical growth literature. This paper analyzes the role of entrepreneurial activity for adjustments of the sectoral structure and its relevance for regional economic development. The historical framework is the accelerated economic transformation that occurred in industrialized countries during the mid 1970s, resulting in an increasing need to adjust. Based on German data from 1975 to 2002, evidence is presented that sectoral reallocations are an important means for transforming entrepreneurial activity into growth.

JEL classification: L26, M13, O1, O18, R11

Keywords: Entrepreneurship, new business formation, regional development, structural change

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1 Introduction

There is a growing body of empirical literature that analyzes the role entrepreneurial activity plays in economic development, but this literature predominantly looks at country or regional differences in levels of entrepreneurial activity and its relationship to economic growth.[1] For the most part, the empirical literature ignores the channels, mechanisms, and dynamics at work in this process.

This paper aims to shed some light on the relation between entrepreneurship and growth by arguing that entrepreneurial activity relates to growth via reallocation of factors across sectors. While the importance of entrepreneurship for the reallocation of factors is widely acknowledged, and economic growth is said to be driven by structural change, there is to date no empirical evidence as to the quantitative importance of this link. This study fills that gap.

To proxy changes in the local sectoral structure induced by entries, a set of similarity measures is introduced that quantifies the impact of new business formation on sectoral reallocations of local economic activity. These measures have in common that they measure the concordance of new entries' sector affiliations with that of existing businesses or those that exit. Next, these measures are used to analyze the relationship between structural change induced by entrepreneurial activity and economic development. The empirical findings suggest that structural change induced by newly founded businesses is positively related to local growth, revealing one element of the complex relation between entrepreneurship and growth. This finding is also consistent with recent claims that it is not start-up activity per se, but the type of start-up, that matters for economic development (Van Praag and Steel, 2010; Fritsch and

[1] See the overviews by Carree and Thurik (2003) and Fritsch (2008).

Schröter, 2009). In this respect, entrepreneurial activity that accelerates changes in the sectoral composition can be especially beneficial for the local environment.

2 Entrepreneurship, structural change, and economic growth

As Echevarria (1997) notes, there are two main schools of thought in the economic literature on how changes in sectoral composition and economic growth interrelate. The neoclassical view considers sectoral composition an unimportant byproduct of growth, whereas scholars such as Kuznets (1971) and Baumol et al. (1989) regard changes in sectoral structure as an important driver of economic growth. The intuition that structural change may relate to economic growth became stronger with the rise of endogenous growth theory, which emphasizes technology-driven input changes (Romer, 1990). The central argument for why changes in sectoral structure may relate to growth is based on the failure to use resources efficiently due to insufficient adjustment to changes in the structure of economic activity. More efficient allocation of resources is closely related to the innovation in products innate to sectoral change and may result in growth. For example, entrepreneurs actively reallocate resources in the present so as to meet an expected future demand. However, as Zagler (2009) notes, structural change is not without cost. Costs of structural change related to entrepreneurial activity include reallocations of factors that fail because the entrepreneur's vision of the future proves to be incorrect, and also involve unemployment and redundant qualifications that arise due to replacement of incumbent businesses. Such an understanding of development is closely related to the view of growth as a process of creative destruction (Aghion and Howitt, 1992).

Entrepreneurship is important in this context because of the organizational limitations of incumbent firms to manage the reallocation of resources, resulting in inefficiencies and reduced

growth. Incumbent firms can suffer from lock-in since there are switching costs, which by definition, are experienced only by incumbents, not by new entries. For example, Grabher (1993) describes such a lock-in for a region; Afuah (2000) for an industry. The aging of firms can be also accompanied by organizational decay that can hinder incumbents in switching activities (Agarwal and Gort, 1996, 2002). Furthermore, empirical research shows that innovative activities may decline with increasing firm age, which might also result in a decreasing ability of incumbents to adjust to necessary changes (Balasubramanian and Lee, 2008). At the level of industries, this tendency toward routinization is also discernable (Klepper, 1996). Incumbents may also reject opportunities because the organizational resources are not sufficient to manage several opportunities, leaving some unexploited (Cassiman and Ueda, 2006).

Restructuring within sectors and restructuring across sectors are both important in this context. Several empirical works argue that internal restructuring in incumbent firms accounts for only part of labor productivity and total factor productivity (TFP) growth, while market selection is responsible for most of the variation (Disney et al., 2003; Baldwin and Gu, 2006; Foster et al., 2006). This view is challenged by other authors. Scarpetta et al. (2002) find that a large share of the increase in labor productivity is caused by internal restructuring and that for TFP growth, internal restructuring has only a slightly smaller impact than external restructuring. In a recent study, Bernard et al. (2010) analyze incumbents' product-switching behavior and find that incumbents' product switches rival those of both recently created and about-to-exit firms. Using data on U.S. manufacturing firms, the authors show that an average of 41 percent of incumbent firms enter new, or exit existing, four-digit industries, while only 16 percent of firms enter or exit their set of two-digit industries. Furthermore, cross-industry product switching by incumbents occurs mostly in related industries, thus resulting in only moderate contributions to

structural change. Overall, the literature does not reveal consistent findings with respect to the importance of entries for within-sector restructuring. However, the empirical evidence suggests that incumbents are better able to manage restructuring within their own field of expertise than they are at managing cross-sectoral reallocations, the topic of analysis in this work.

The first and most obvious way cross-sector reallocation occurs via new business formation is simply because the sectoral affiliation of new businesses differs from the sectoral structure of incumbent businesses, e.g., entry occurs in sectors new to the country or region. Changes in the sectoral structure due to entry can be an indication of variety generated through recognition of opportunity, which is one basic function of entrepreneurship (e.g., Gartner, 1989). In the long run, new and different business is a vital antidote to "lock-in" situations (David, 1994, 2007; Fagerberg, 2003). Not all new firms and businesses are born from pure innovation, of course, but even those whose start is based in a knowledge-distribution function (Klepper, 2002, 2007; Koster, 2007) through replication of existing practices can be of crucial importance for sectoral reallocation. New business formation that fulfills this function is an important component of the adaptation process (e.g., Metcalfe, 2005) since new businesses that replicate successful (new) patterns can affect the capacity and speed of responding to change.

In summary, two components are crucial to understand the role of entrepreneurial activity in structural change induced growth. First is the failure of incumbent firms to efficiently manage reallocation of factors across sectors because of organizational limitations. The second component is the variety-generation and opportunity-recognition functions of new businesses, which help reallocate economic activities and result in a more efficient use of factors.

To date, most analysis of the relationship between entrepreneurial activity and regional growth focuses on the effects of entry rates and does not take into account reallocations across

sectors. This paper draws attention to shifts in the sectoral structure caused by new business formation and argues that it is not only differences in the level of entrepreneurial activity but also differences in entrepreneurial ability to organize reallocations of factors across sectors that is conducive for economic growth. This is especially true since structural change and the process of adjustment become of ever increasing relevance in developed economies.

3 Local characteristics and their influence on entrepreneurial activity

Entrepreneurial activity is heavily influenced by local environmental factors, including the sectoral dimension of the environment. Because the sector affiliation of new business formation is not independent of the entrepreneur's environment, this section discusses the ramifications of this interrelationship. This interrelationship is not only due to the fact that most founders locate their business near where they live (e.g., Cooper and Dunkelberg, 1987), neither is it completely dependent on the fact that entrepreneurs tend to rely on opportunities they learned about in previous employment (Bhidé, 2000). Urbanization, localization, and pecuniary externalities can also have an impact, and sometimes a very strong one, on the industry affiliation of entries. For example, location decisions can be influenced by proximity to customers, other firms, and specialized inputs, all of which have a different influence on firms in different industries (LaFountain, 2005). Another factor is the business size structure of the industries present in the region, which can impact new business formation due to an effect on local entrepreneurial attitudes (Beesley and Hamilton, 1984; Sorensen and Audia, 2000), or may proxy entry cost differences (e.g., minimum efficient firm size; Fritsch and Falck, 2007). The existing sectoral structure also shapes the regional (formal) qualification structure and work experience, which can have a great influence on the sectoral structure of new businesses in the region. Other regional inputs also can channel the sectoral structure of new business formation. For example, at

a more abstract level, a greater tendency to or ability at perceiving and then acting on opportunity can be influential. Another important factor that is strongly related to qualification, local knowledge resources, and the recognition of opportunity is the technological regime, which may differ between countries and regions. An entrepreneurial regime is characterized by a high level of opportunity, lack of appropriability, and a low degree of cumulativeness, which results in a low concentration of innovative activity and high entry rates, whereas a routinized regime is characterized by opposite conditions and outcomes (Nelson and Winter, 1982; Malerba and Orsenigo, 1993, 1997).

4 Data, historical background, and measurement

The data used in this study are taken from the Establishment History Panel, which is based on official German employment statistics. These data were collected by the Institute for Employment Research (IAB) of the German Federal Employment Agency. The data set contains establishment-aggregated information derived from social security data for the period 1975 to 2002. One of this data set's biggest advantages is that it can be used to analyze regional-based research questions. The units of observation are 326 NUTS3 regions (Landkreise), which are roughly comparable to U.S. counties. The data set allows distinguishing 292 industries, the classification of which did not change during the period under investigation.

Comparing West German economic centers in the 1970s and those of today reveals some reshuffling in this area. In 1975, West Germany, then the third largest economy, experienced the largest economic decline in its history—one only exceeded by the economic crisis of 2009. Many scholars tend to interpret the date of the oil-price shock—1973/1974—as a break in the development of industrialized countries. At that time, the German economy underwent major

changes, including de-industrialization and the emergence of new industries. These economic, social, and cultural breaks led to drastic consequences that continue to manifest. This period has been given various labels, for example, the "post-industrial age" (Bell, 1973), "post-modernism" (Lyotards, [1984] 1993), and "culture shift" (Inglehart, 1977, 1990), all of which demonstrate not only the complexity of the time but also the variety of perspectives with which it is viewed (Faulstich, 2004). The terms "post-industrial age" and "post-modernism" emphasize the collapse of existing patterns; "culture shift" more implies the evolution of new elements (Jarausch, 2006). In short, society experienced a sense of beginning as well as one of ending. During this era, structural changes became more and more important for all industrialized countries, making it a very appropriate period in which to study the impact of changes in sectoral structure introduced by new business formation.

5 Measuring the impact of entries for sectoral reallocation

To proxy the role new businesses play in sectoral reallocations, two different measures are employed:

- the regional similarity of the sectoral structure between new businesses (entries) and incumbents leaving the market (exits), and
- the regional similarity of the sectoral structure between new businesses (entries) and the initial sectoral structure of a region in 1975 (incumbents' initial industry structure).

For both measures, high similarity means a low ability of entries to actively change the local sectoral structure in terms of the businesses operating in a region. Similarity between entries and exits is based on a vector of entries and a vector of exits containing information about the local number of businesses for each industry. This measure is based on variables that vary

over time and region. Similarity between entries and the initial industry structure is based on one vector that contains information about the number of businesses in different industries in 1975 and is always the basic benchmark for measuring the similarity to new business formations in later years. The second vector for calculating similarity is based on the regional sectoral structure of new businesses that enter the market in the respective year. Again, this measure varies over time and space. However, since the second vector is time invariant, this measure is of limited practice in panel analysis and thus is used only in cross-section analysis.

To avoid the results being biased by entries that leave the market after a very short period, calculation of similarity is based only on those businesses that have been in existence for at least five years. However, information for entries that survived at least five years is not available for the years 2001 and 2002. We use the number of businesses, instead of employment in new businesses and incumbents, since large standard deviations in firm size within one industry can easily cause severe bias, especially in industries that include large incumbents.

Since using different methods to calculate similarity measures might yield different results, we compare two different measures: a correlation coefficient similarity measure and a cosine similarity measure. The appropriateness of using the correlation coefficient similarity measure is questioned by Ahlgren et al. (2003) in a paper that analyzes its aptness for measuring authors' co-citation profiles. The authors argue that this measure is sensitive to zeros. The addition of zeros to both vectors should increase similarity; however, the correlation coefficient does the opposite. However, Bensman (2004) argues for use of the correlation coefficient similarity measure even in the case of many zeros and suggests solving the problem by logarithmic transformation, and White (2003) states that Ahlgren et al.'s argument is of little practical relevance. Additionally, some statistical properties of a correlation-based similarity

measure have been shown to cause problems that can be avoided by using cosine similarity (see van Eck and Waltman, 2007). However, the authors also point out that these problems are of relevance only when correlation-coefficient-based results are substantially different from those achieved by other methods. Since the correlation coefficient similarity measure and the cosine similarity measure are highly correlated and do not lead to different results in the following descriptive analysis, the correlation coefficient similarity measure is used here. Alternatively, similarity measures that consider only those industries with at least one entry were calculated; these turned out to also be highly correlated and did not change the results reported here. We also tested similarity measures that use industry shares of employment as weights in order to consider the relative regional importance of an industry. However, weighting based on the current importance of industries ignores the possibility of changes in importance in the future, which is one of the basic assumptions in the context of structural change. In general, all results presented in this paper are robust to different specifications of similarity.

Even this approach, however, has a disadvantage: the relatedness among industries itself is not taken into account—every different industry results in a different observation when calculating similarity. To address this problem, we aggregate the data to 19 broadly defined private industries since a higher level of aggregation can be expected to be less affected by interindustry similarity. Aggregating industries so as to calculate similarity also has the advantage that it is easier to control for the industry composition of a region since it is much more convenient to include the employment shares of 18 out of 19 aggregated industries than to work with more than 200 industry shares. Thus it is possible to control for all industry shares in a regression that is also used to calculate similarity. However, all measures of similarity are highly correlated and thus all analyses presented in this paper were double-checked using a similarity

measure based on all private industries at the three-digit level. For the correlation between entries and exits (entries and incumbents in 1975), a value of 1 means perfect replication of the existing sectoral structure, that is exits and entries are equal (assuming no net exit or net entry). However, perfect similarity between entries and the initial sectoral structure in 1975 only means that the initial sectoral structure is replicated; changes in the sectoral structure could have taken place due to exiting incumbents.

6 Results

6.1 Similarity between entries and the initial sectoral structure in 1975

To obtain a first impression of the degree to which the sectoral structure of new business formation is correlated with the initial sectoral structure in a region, Figures 1-3show the correlation coefficient similarity measure between existing industries in the base year 1975 and entries in 1976, 1986, and 1996. The upper map of each figure shows similarity based on all entries; the lower map shows similarity based on entries that survived at least five years. The highest similarity in sectoral structure is observed in the Ruhr area and northern Germany; additionally, some of the older industrialized areas in southern Germany have relatively high similarity. Although the main agglomerated areas show relatively high values of similarity, this phenomenon is not limited to agglomerations since many rural areas in the northern part of Germany have considerably high similarity rates as well.

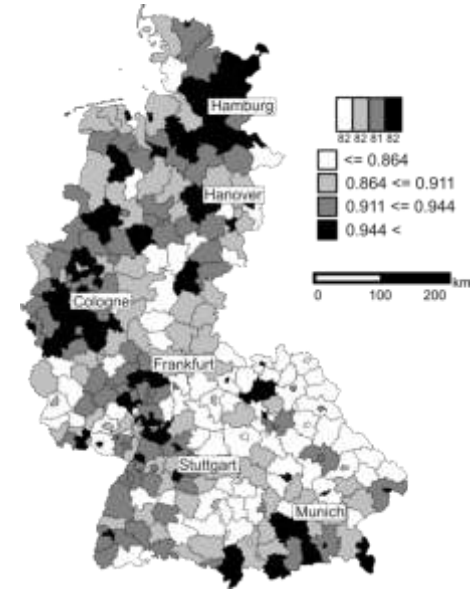


Figure 1: Industry similarity between new businesses in 1976 and the initial sectoral structure of 1975

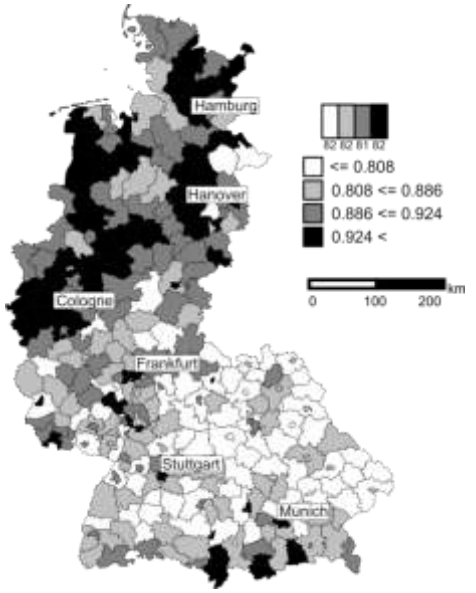


Figure 2: Industry similarity between new businesses in 1986 and the initial sectoral structure of 1975

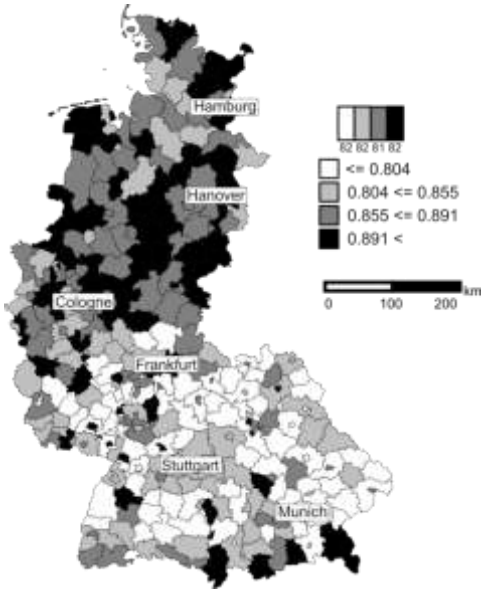
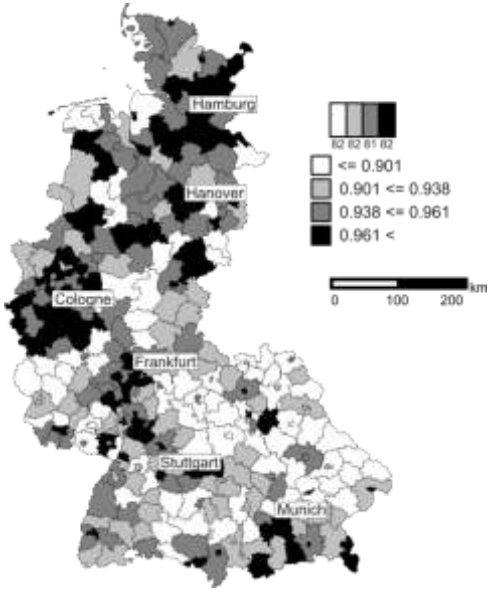
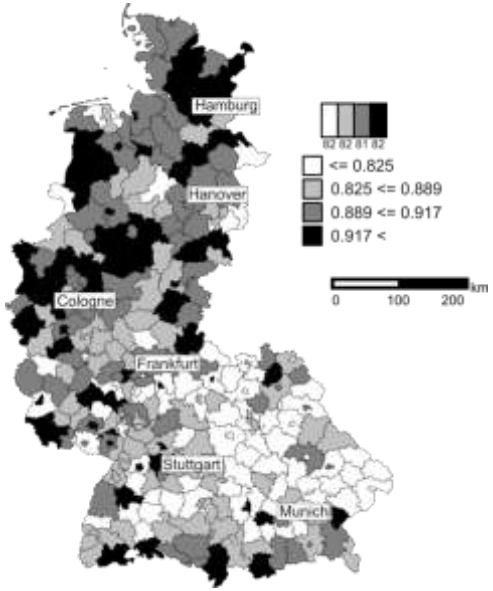
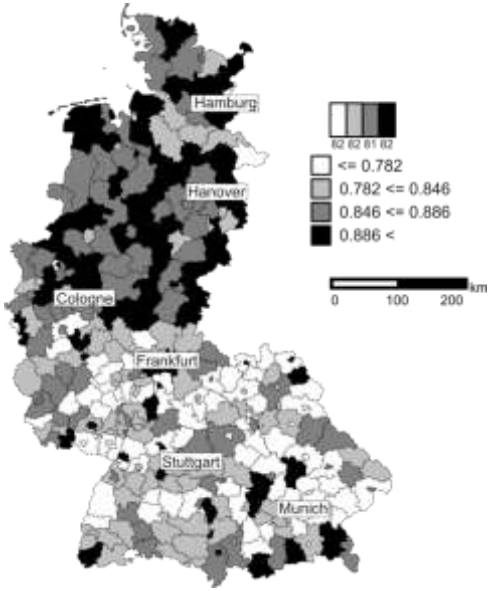


Figure 3: Industry similarity between new businesses in 1996 and the initial sectoral structure of 1975







Note: top, all entries; *bottom,* entries that survived at least 5 years.

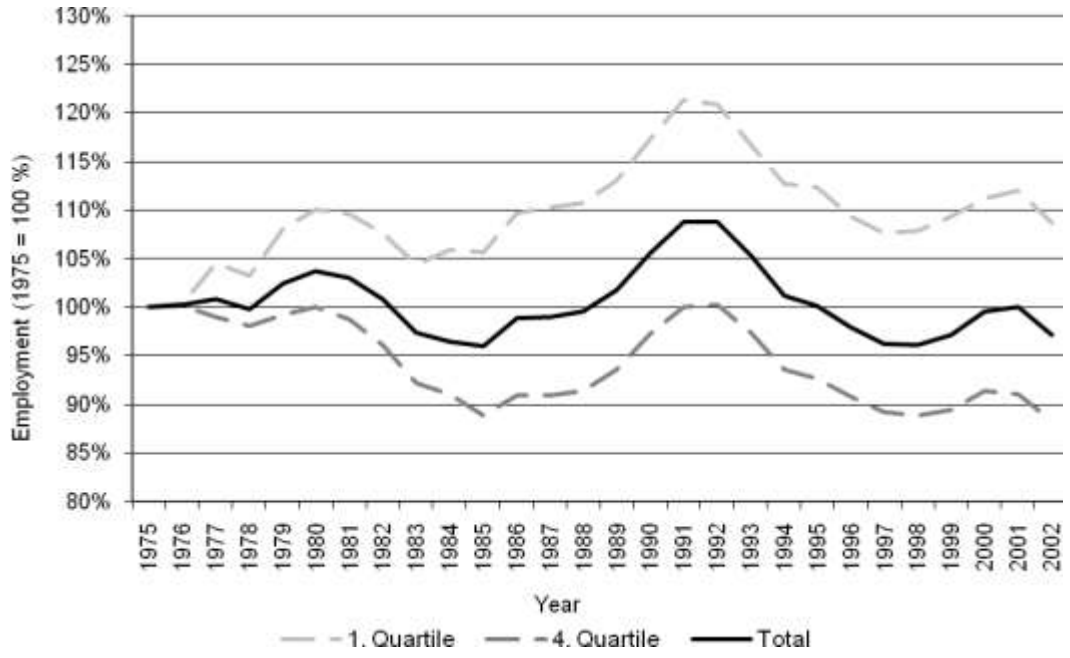


Figure 4: Average employment development for regions with low (1st quartile) and high (4th quartile) similarity between entries and initial sectoral structure in 1975

Focusing on those regions within the first and fourth quartiles of similarity between entries and initial sectoral structure reveals that employment growth in regions with low similarity was better than that in regions with high similarity. Figure 4 illustrates the development of full-time employment in private industries for regions within the first and fourth quartiles of sectoral similarity between entries and the initial structure in 1975. In determining whether a region belongs to the first or the fourth quartile, we use the region's average similarity for the total period.

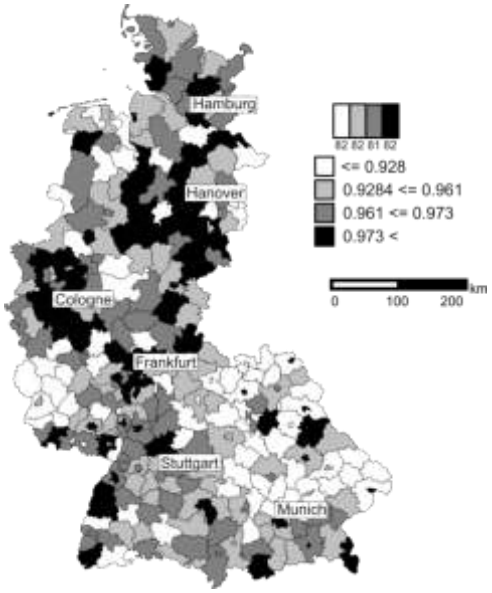
From 1975 to 1991, the gap in employment development between regions in the first and fourth quartile increases steadily. With respect to initial employment, this gap is around 21 percent. During 1991 to 2002, the gap remains nearly the same size, with a slight decrease in the difference of about 18 percent. Note that this better performance in employment development in regions with low similarity is due to both better performance of those businesses that existed

prior to 1975 and those new businesses that entered after 1975. In regions within the first quartile (low similarity), employment in businesses that existed prior to 1975 declined to around 62 percent of their initial employment in 2002. For regions within the fourth quartile (high similarity), by 2002, the incumbents had only 45 percent of their initial employment (compare Figure A1 in the Appendix). For the employment development of entry cohorts after 1975, regions with low similarity show significantly better performance (see Figure A2 in the Appendix).

6.2 Sectoral similarity between entries and exits

Analyzing the similarity of entries and exits has some advantages over analyzing the similarity of entries and some historic sectoral structure, chief among them being that the sectoral structure of entries and exits accounts for the interplay between new and incumbent businesses. One main disadvantage of investigating the similarity of entries and some initial sectoral structure is that changes in this initial structure over time (e.g., due to exits) are not taken into account.

Similar to Figure 1–3, Figure 5–7 show the spatial distribution of local sectoral similarity between entries and incumbents exiting the market in 1976, 1986, and 1996. Again, the upper map of each figure shows similarity based on all private entries; the lower map reports similarity based on all private entries that survived at least five years. In these figures, the similarity between entries and exits appears to be more widely dispersed and the difference between north and south German regions is less obvious compared to the similarity between entries and initial sectoral structure in 1975.



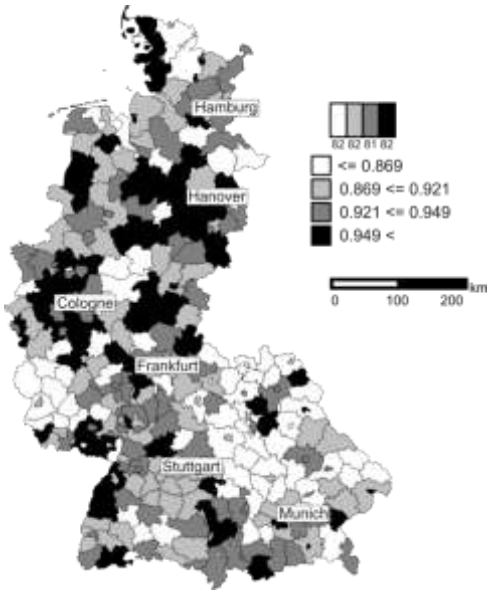
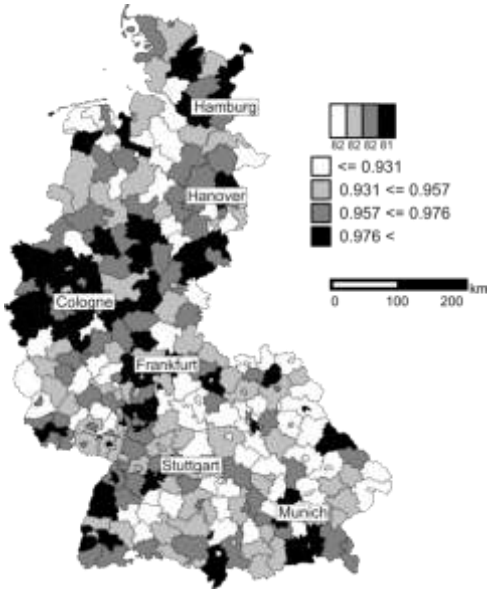


Figure 5: Industry similarity between entries and exits in 1976



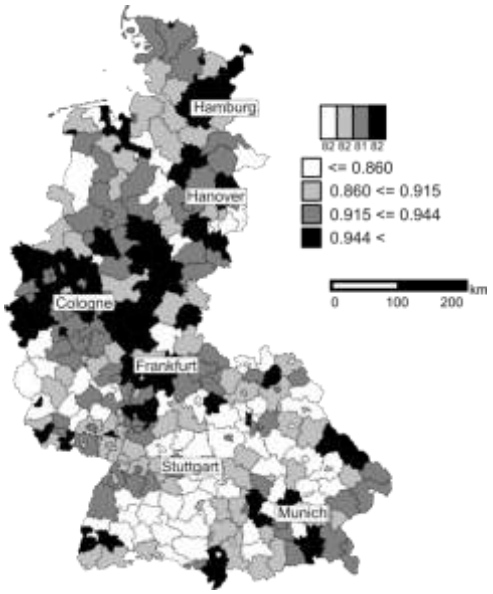
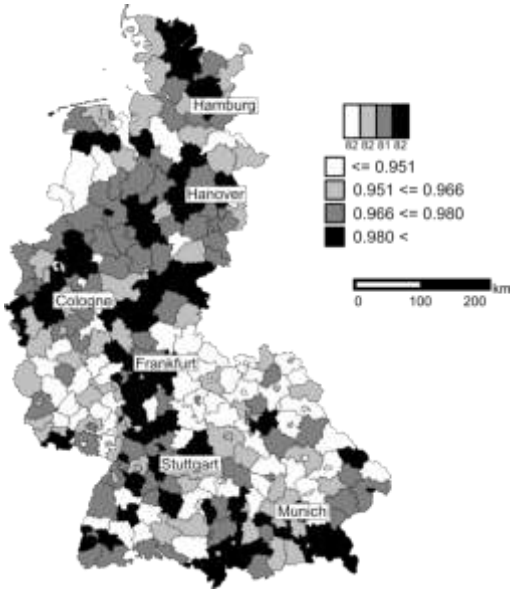


Figure 6: Industry similarity between entries and exits in 1986



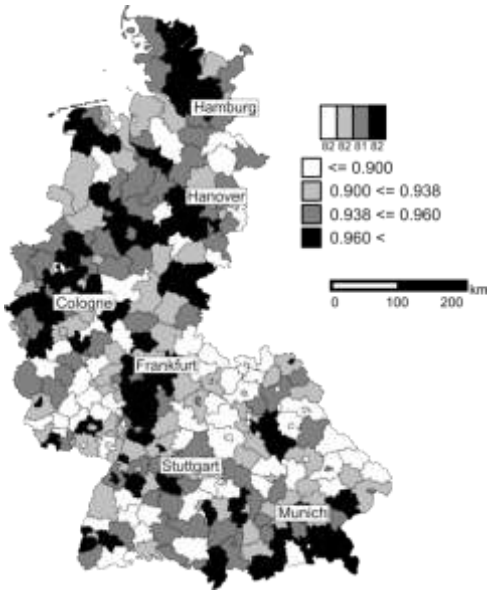


Figure 7: Industry similarity between entries and exits in 1996

Note: top: all entries; bottom: entries that survived at least 5 years.

Figure 8 illustrates the development of full-time employment for regions within the first and fourth quartiles of sectoral similarity between entries and exits. Again, regions with low similarity perform better than regions with high similarity. The gap in employment development between regions with low/high similarity is smaller than the gap observed in Figure 4. This is because there are more changes in the regions belonging to the first and fourth quartiles over time. Since classification into quartiles is based on regional mean values over the whole period, the difference in employment development is to some extent less strong.

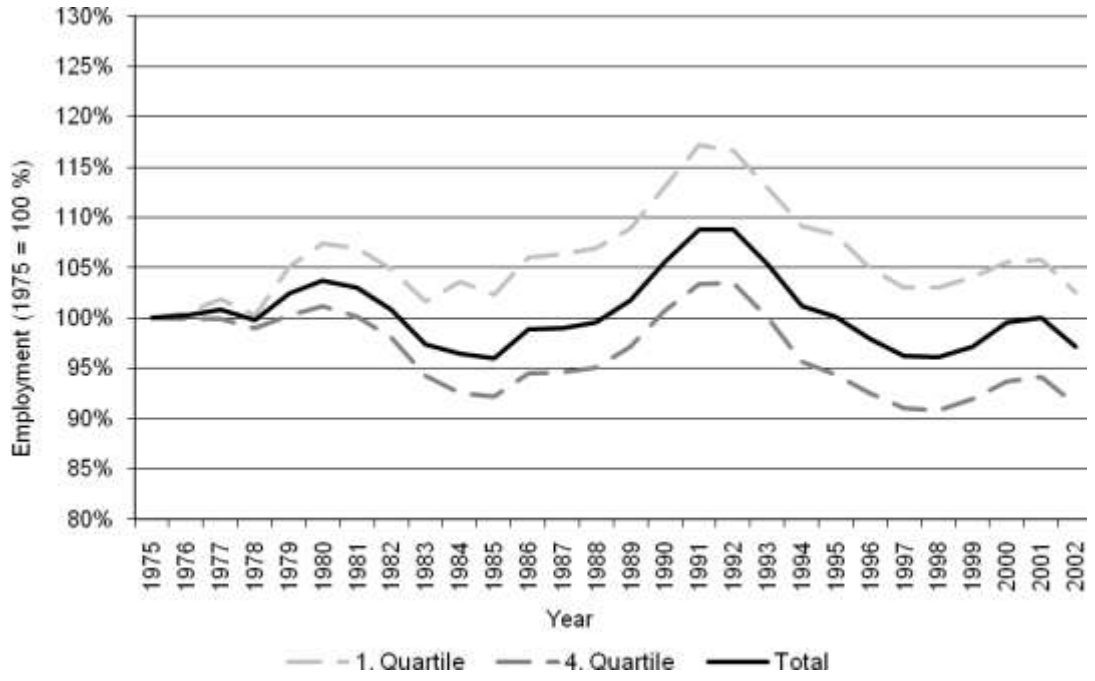


Figure 8: Employment development for regions with low (1st quartile) and high (4th quartile) similarity between entries and exits

Again, the better performance of regions with low similarity can be explained by the better performance of incumbent businesses, as well as better performance by entries, a finding that emphasizes the importance of the initial sectoral structure in adapting to changes that are brought about by the entry of new businesses.

However, the descriptive analysis has several shortcomings. At the regional level, the sectoral similarity between entries and incumbents might be mainly the result of industry-specific effects. For instance, specialization in a certain industry might make it easier for a region to diversify, whereas the same situation in another industry would not have such an effect.

One example of this situation is a region containing industries for which cross-sectoral technology is important. These industries can positively influence entry activity in industries different from the initial sectoral structure. Furthermore, the simple fact of similarity does not tell much about whether it is "good" or "bad" similarity—i.e., similarity in industries that are doing well is not exactly a bad thing—making it difficult to interpret the above observations. Additionally, the descriptive analysis might be strongly influenced by agglomeration effects: an agglomeration with many different industries can have higher similarity merely because it has both a relatively high number of incumbents and a substantial number of entries, whereas in a rural area, entry might be such a rare event at the industry level that low similarity is basically a statistical artifact and employment growth differences are simply due to a convergence process between rural and more dense areas. Moreover, the agglomerated and most highly industrialized areas are especially affected by major structural changes and thus drive a process of convergence. Due to all these limitations of the descriptive analysis, it is necessary to perform a multivariate analysis that allows controlling for the region-specific sectoral structure as well as for other important drivers of regional growth.

6.3 Cross-section analysis

To this point, it is not possible to conclusively state that entrepreneurial activity is related to growth via reallocations across sectors since local industry-specific effects might impact the similarity measure as well as the performance of incumbents and new entries. Due to the prior

analysis that revealed severe, as well as over-time consistent, differences in similarity between entries and the initial sectoral structure in 1975, we first conduct a cross-section analysis. This strategy is also appropriate since similarity between entries and the initial sectoral structure is always measured in comparison to a fixed initial point in time. A major drawback of this strategy is that we cannot control for region-specific fixed effects and thus drawing conclusions from a cross-section analysis could be problematic because the regional industry similarity between entries and incumbents might be only a proxy for unobserved time-invariant region-specific characteristics that cause the employment growth. For a general discussion on implementing structural change in empirical growth models, see Temple and Wößmann (2006).

To test the hypothesis that entrepreneurial activity is beneficial for growth via structural change, we regress regional long-run employment change on the similarity measures. Long-run growth rates are computed for the period 1983 to 2002 and all control variables are computed as regional averages for the period 1975 to 1982. The central explanatory variable is the average similarity between new business formations that survived at least five years during the period 1976 to 1982 and the initial industry composition in 1975. The share of highly qualified workers, industry concentration, and population density are included as controls. A proxy for the regional share of employees in small businesses is included since previous research emphasizes the importance of small business presence to local entrepreneurial attitudes (Beesley and Hamilton, 1984; Sorenson and Audia, 2000). The share of employees in small businesses is also frequently interpreted as an indication of the extent of entrepreneurship and competition in a region (Glaeser et al., 1992; Glaeser et al., 2010). Moreover, the start-up rate (number of start-ups over the workforce) is included in some specifications, since the start-up rate is a more direct signal of local entrepreneurial activity. Additionally, we use data on the employment shares in 18 out of

19 aggregated private industries so as to consider regional sectoral structure in the estimation. This is important because industries differ in their factor input combinations. To control for the possibility that it is not only regional variables, but also proximity to other markets, that is important, a Harris-type market potential function is included (see Südekum, 2008; Redding and Sturm, 2008). The results are reported in Table 1.

The results in Column 1 of Table 1 show that new businesses having an industry structure highly similar to that of the initial industry structure has a significant negative relationship to the long-run growth of total employment. Column 1 also shows a significant positive impact of the share of highly skilled workers, a significant negative impact of population density, a significant positive coefficient of small business employment share, and a significant negative effect of industry concentration. All results for the control variables are in line with earlier empirical research for German regions (see, e.g., Südekum, 2008). In Column 2, the same equation is estimated but as a control for the regional industry structure we included the employment shares of 18 out of 19 aggregated industries. The estimated negative effect of similarity of entries decreases considerably, highlighting the importance of existing industry structure to the sectoral structure of entries. This could mean that path dependency plays an important role since specifics of the local industry structure may allow entries to be less correlated with the initial structure. However, the negative impact of similarity means there are differences between regions that allow a higher degree of industry structure adjustment given a certain initial industry structure.

Table 1: Cross-section regression results for sectoral similarity between entries that survived at least 5 years and the initial industry structure in 1975

Dep. variable: employment growth 1983–2002				
	(1)	(2)	(3)	(4)
Similarity between entries and initial	-0.439***	-0.329**	-0.507***	-0.412***
sectoral structure in 1975 (log)	(0.17)	(0.15)	(0.17)	(0.15)
Start-up rate (log)	–	–	0.185***	0.183***
			(0.066)	(0.053)
Highly skilled employment	0.102***	0.115***	0.0885***	0.0936***
share (log)	(0.029)	(0.029)	(0.029)	(0.028)
Population density (log)	-0.0529***	-0.0351**	-0.0535***	-0.0424***
	(0.013)	(0.014)	(0.012)	(0.015)
Market potential (log)	0.0140	0.0407	0.000721	0.0405
	(0.028)	(0.031)	(0.027)	(0.031)
Small business	0.636***	0.783***	-0.110	-0.0493
employment share	(0.18)	(0.20)	(0.31)	(0.31)
Industry concentration	-0.553*	-0.825***	-0.520	-0.743**
(Gini)	(0.33)	(0.29)	(0.34)	(0.30)
Constant	0.749	0.335	1.959***	1.319**
	(0.47)	(0.47)	(0.60)	(0.56)
Control for industry composition	No	Yes	No	Yes
R^2	0.3540	0.5377	0.3749	0.5559

Note: Total employment growth is log(empr,1998 /emp r,1983). New business similarity is the average correlation coefficient similarity measure for the period 1976 to 1982 based on 19 aggregated private industries. All other independent controls are mean values for the period 1975 to 1982. Coefficients for the initial industry composition are omitted for the sake of brevity. OLS estimation with robust standard errors in parentheses. Significant at *** 1%, ** 5%, * 10%. The number of observations is 326.

In Columns 3 and 4 of Table 1, the start-up rate is included. The only basic difference from Columns 1 and 2 is that the share of employees in small businesses is no longer significant, which may mean that differences in the regional firm size structure reflect entrepreneurial activities. Table A1 in the Appendix reports results for the effects of similarity between entries and the initial industry structure in 1975 based on all three-digit industries. Table A3 in the Appendix provides an overview of the different definitions employed in calculating similarity. In general, the negative relationship between sectoral similarity and employment growth is robust to different definitions of similarity.

The similarity of entries to the initial sectoral structure in 1975 is strongly related to a comparison of the industry affiliation of new businesses with some historic local industry composition; however, similarity between entries and exits relates to the current industry similarity of businesses that enter, and incumbent businesses that leave, the market. A high similarity might be especially prevalent in a regime in which entries simply replace exiting businesses. Table 2 reports cross-section results using sectoral similarity between entries that survived at least five years and exits as an explanatory variable. Basically, all models of Table 1 are reestimated in Table 2, with the only difference being that sectoral similarity between entries and the initial structure of 1975 is replaced by the average sectoral similarity of entries and exits.

Table 2: Cross-section regression results for sectoral similarity between entries that survived at least 5 years and exits

Dependent variable: employment growth 1983–2002				
	(1)	(2)	(3)	(4)
Similarity between	-0.441***	-0.384***	-0.453***	-0.401***
entries and exits (log)	(0.097)	(0.093)	(0.098)	(0.093)
Start-up rate (log)	–	–	0.173***	0.175***
			(0.061)	(0.049)
Highly skilled employment	0.116***	0.128***	0.102***	0.106***
share (log)	(0.029)	(0.028)	(0.028)	(0.027)
Population density (log)	-0.0498***	-0.0361**	-0.0513***	-0.0436***
	(0.012)	(0.014)	(0.012)	(0.014)
Market potential (log)	0.0197	0.0416	0.00720	0.0410
	(0.028)	(0.030)	(0.027)	(0.030)
Small business	0.604***	0.769***	-0.102	-0.0290
employment share	(0.16)	(0.19)	(0.29)	(0.29)
Industry concentration	-0.511*	-0.806***	-0.478	-0.728**
(Gini)	(0.31)	(0.28)	(0.32)	(0.29)
Constant	0.649	0.357	1.789***	1.311**
	(0.029)	(0.47)	(0.58)	(0.54)
Control for industry composition	No	Yes	No	Yes
R^2	0.3858	0.5606	0.4044	0.5776

Note: Total employment growth is $\log(emp_{r,1998} / emp_{r,1983})$. New business similarity is the average correlation coefficient similarity measure for the period 1976 to 1982 based on 19 aggregated private industries. All other independent controls are mean values for the period 1975 to 1982. Coefficients for the initial industry composition are omitted for the sake of brevity. OLS estimation with robust standard errors in parentheses. Significant at *** 1%, ** 5 %, *10 %. The number of observations is 326.

We find a significant negative association of the similarity of entries to those of exits and local employment growth. When comparing the employment effects of industry similarity between entries and the initial sectoral structure to those of the similarity between entries and exits, we find somewhat larger negative coefficients for similarity between entries and exits. The explained variance is also somewhat higher in those models using the similarity between entries and exits. Since the reported effect might be the result of a convergence process between rural areas and more dense areas that is not captured by the density control variable, Table A2 in the Appendix reports estimation results for agglomerations only; the results confirm those reported here.

6.4 Panel analysis

As discussed above, the cross-section analysis can be problematic because what looks like similarity might instead be a proxy of other time-invariant regional characteristics that have an impact on employment growth. Therefore, we estimate the impact of similarity between entries and exits on local growth in a panel that allows consideration of region-specific fixed effects. We use the similarity of entries to exits, since both underlying vectors that were used to calculate similarity vary over both region and time. Since similarity between entries and the initial sectoral structure in 1975 always relates back to one time-invariant vector, this measure is not used in the panel analysis. This procedure is also supported by the variance components of both measures. The within variance of similarity between entries and exits is larger than the between variance; the opposite is true for similarity between entries and the initial sectoral structure. Overall, the ratio of within and between variance for similarity between entries and exits is more than 1.6 times larger than the variance ratio of similarity between entries and the initial sectoral structure. The following equation is estimated:

$$\Delta Emp_{r,t}\alpha + \mu_r + \lambda_t + \beta_1 similarity_{r,t-1} + \gamma X_{r,t-1} + \varepsilon_{r,t}, \quad (1)$$

where $Emp_{r,t}$ is the regional employment in private industries, $similarity_{r,t-1}$ is the time-lagged local sectoral similarity of entries and exits, $X_{r,t-1}$ are other exogenous variables[2], μ_r is a regional fixed effect, λ_t a time fixed effect, and $\varepsilon_{r,t}$ is the error term. To calculate similarity, all entries are used since information about entries surviving at least five years is not available for the last two years of the study period. However, limiting the period from 1976 to 2000 and using similarity based on entries that survived at least five years does not change the general results (see Table A4 in the Appendix). Table 3 reports the results of a fixed effects regression.

Column 1 of Table 3 estimates Equation (1) for all 326 regions, Column 2 for agglomerated regions, Column 3 for moderately congested areas, and Column 4 for rural regions only. We find a significant negative impact of sectoral similarity between entries and exits on local growth for the total sample and for all three subsamples. However, the negative effect of sectoral similarity between entries and exits on employment growth is largest in agglomerations. This is in line with the special role that urban areas are expected to play in entrepreneurship and innovation. Comparing the results in Table A4 (similarity based on entries that survived at least five years) to those in Table 3 (similarity based on all entries) shows that the coefficient of industry similarity is much smaller in absolute terms when measuring similarity based on businesses that survived more than five years. This is because a measure that contains all entries appears better suited for characterizing regions in which entries replace exits but then have to exit the market themselves due to being replaced by yet another new firm. In Table A4 in the

[2] Prior research suggests that entrepreneurial activity, measured by start-up rates, relates to growth over a relatively long period of time and thus its application in panel analysis requires inclusion of multiple time-lagged realizations of start-up activity, reducing the number of years that can be used in the analysis (Fritsch, 2008). Therefore, the share of small business employment is a better proxy in this approach to account for regional differences in entrepreneurial activity in this setting and exclusively used in the panel analysis (see also Glaeser et al., 1992, Glaeser et al., 2010).

Appendix we further limited the sample to highly agglomerated cities and regions that had on average more than half a million inhabitants. Based on these 13 urban areas, the relation between sectoral similarity of entries and employment growth is much stronger in an urban environment.

In general, the results from the panel analysis support the findings of the cross-section analysis: regions with a higher ability to adjust their sectoral structure due to new entries perform better with respect to local employment growth.

Table 3: Panel regression results for sectoral similarity between entries and exits

Dependent variable: yearly employment growth				
	All regions	Agglomera-tions	Moderately congested areas	Rural regions
	(1)	(2)	(3)	(4)
Sectoral similarity between entries and exits (log), t-1	-0.0481***	-0.0572***	-0.0430***	-0.0393***
	(0.0082)	(0.015)	(0.013)	(0.014)
Highly skilled employment share, t-1	0.346***	0.130**	0.513***	0.291
	(0.054)	(0.063)	(0.11)	(0.21)
Population density (log), t-1	-0.00808	-0.0845***	0.0494**	-0.0115
	(0.013)	(0.021)	(0.020)	(0.031)
Market potential (log), t-1	0.228***	0.171***	0.351***	0.328***
	(0.033)	(0.036)	(0.055)	(0.067)
Small business employment share, t-1	0.751***	0.542***	0.944***	0.821***
	(0.027)	(0.039)	(0.046)	(0.056)
Industry concentration (Gini), t-1	-0.185***	-0.117**	-0.360***	-0.277***
	(0.035)	(0.048)	(0.062)	(0.079)
Constant	-3.080***	-1.771***	-4.803***	-4.011***
	(0.36)	(0.40)	(0.61)	(0.72)
Time dummies	Yes	Yes	Yes	Yes
Control for initial industry composition	Yes	Yes	Yes	Yes
F-test	114.28 (0.00)	56.25 (0.00)	55.24 (0.00)	29.95 (0.00)
R^2 (within)	0.4037	0.4521	0.4055	0.4449

Note: The estimation method is fixed effects regression. The number of observations in Column 1 is 8,476, in Column 2 3,094 (119 regions), in Column 3 3,666 (141 regions), and in Column 4 1,716 (66 regions). Significant at *** 1%, ** 5 %, * 10%.

7 Initial sectoral structure and sectoral similarity of entries

The prior sections studied entry-driven cross-sectoral reallocation and its relation to growth based on broadly defined sectors of the economy. This section analyzes the potential for entry-driven reallocation within the borders of a certain sector since prior research emphasizes that diversification into related industries is more likely to happen than diversification into unrelated industries (Neffke et al., 2009). In addition, the initial sectoral structure may impact the sectoral similarity of subsequent entries because of industry-specific differences. An extreme case would involve sector-specific factors that are relatively immobile between industries and thus costly to move across industries (e.g., industry-specific human capital). But also, industry-specific technologies and modes of innovation may allow entrepreneurs to reallocate resources either more easily or with more difficultly across industries (e.g., due to a focus on general purpose technology). As such, an initial industry structure with a focus on industries that allow easier diversification into different fields leads to less similarity in the industry structure of entries and thus a higher degree of adjustment. It follows that "dynamic capabilities" not only exhibit a firm-specific competitive advantage (Teece et al., 1994; Teece and Pisano, 1994), but can also be expected to differ between industries. These industry-specific-level differences in "dynamic capabilities" may influence local ability to adjust.

To describe how different sectoral core areas of regions can shape the local similarity of entries within certain sectors in different ways, two sectors are analyzed in more detail. To this end, similarity patterns at the three-digit level within the borders of two broader sectors are studied. The textile and leather industry (consisting of 30 different three-digit industries) and the chemicals and plastics industry (consisting of 16 different three-digit industries) are used to describe how local sectoral differences can shape the regional similarity of subsequent entries.

There are two reasons these two sectors should have different patterns in sectoral similarity between entries and incumbents. First, the economic changes during this period led to industry shifts among the industrialized countries, during which the West German chemical industry was able to maintain and even increase its international competitiveness. West German textiles, on the other hand, lost out to international competition. These sectoral shifts should have led to new entries in chemicals and plastics in Germany due to losses in other countries. However, one should expect these entries to be less similar to incumbents due to the higher diversification potential of these industries. Another difference between the two sectors has to do with mode of innovation. In the famous Pavitt taxonomy (Pavitt, 1984), chemicals are included in the science-based industries, while textiles belong to the supplier-dominated industries. Supplier-dominated industries are characterized by a reliance on innovations external to the firm, whereas science-based industries are said to develop product and process innovations in house as well through university research, which has a high degree of appropriability. These two central characteristics—the difference in competitive advantage and the difference in mode of innovation—should result in differences in diversification potential and necessity to adjust, and thus lead to different dynamics in sectoral similarity.

Thus, sectoral similarity between entries and incumbents in the chemical and plastic industry should be relatively low and rather stable, while it should be higher in the textile industry since the diversification potential of this industry can be expected to be relatively lower. However, over time, similarity in the textile industry should decrease due to adjustment necessities since West Germany is losing ground in this industry in comparison to other countries. In the chemical industry, similarity should be stable or increase since West Germany

has been able to maintain, and even increase, its competitive advantage over time. Table 4 summarizes the expected similarity pattern for these two industries.

Table 4: Expected similarity pattern in the textile and chemical industries

	Sectoral similarity between entries and exits
(1) Textile and Leather (Lower diversification potential; increasing competitive disadvantage relative to other countries)	Higher level of initial similarity than *(2)* due to lower diversification potential; decreasing similarity over time due to adjustment caused by shifts of competitive advantage to other countries
(2) Chemicals and Plastic (Higher diversification potential; stable/increasing competitive advantage relative to other countries)	Lower level of initial similarity than *(1)* due to higher diversification potential, stable/increasing over time since the main competitors are in the same country

The history of the textile industry demonstrates that adjustment processes can take a rather long time. Figure A3 in the Appendix displays the development of textile incumbents founded prior to 1976 and of the entry cohorts of 1976, 1986, and 1996. Both incumbents and newcomers suffered a strong decrease in employment. Total employment in textiles decreased by more than 150,000 employees from 1975 to 1982, a loss of more than 20 percent of the initial employment. However, while the total number of firms decreased by almost 30 percent between 1975 and 1982, entry in this industry—although decreasing—was still common. The entry cohort of 1976 created nearly 10,000 jobs in the year of entry. However, by the second year after entry, almost 10 percent of these jobs had disappeared. The entry cohort of 1986 entered the market with around 6,500 full-time employees; 16 years later only 23 percent of these employees were still working in textile businesses founded in 1986. Even after 27 years, there is not much evidence of stabilization in the textile industry: there were around 5,400 employees in the entry cohort of 1996, of which only 80 percent remained six years later. No doubt there are some entrants that found and successfully filled a niche and contributed positively to regional growth

but, on average, regions that had a focus on textiles and did not manage to create successful new industries suffered loss in the existing industry accompanied by the failure of new entries.

The chemicals and plastics sector is a totally different story. Figure A4 in the Appendix shows that both the incumbents in existence prior to 1976 and the entry cohorts of 1976, 1986, and 1996 performed very well, even though within the three-digit level of chemical and plastics one can observe severe differences, suggesting that there were major changes in sectoral structure within these related industries. The entry cohort of 1976 created more than 5,600 jobs, and subsequently increased this number. Employment in the entry cohort of 1996 was almost 3.5 times larger compared to initial employment in the cohort of 1976. Six years later, entries in the chemicals and plastics industry increased employment by almost 30 percent. Incumbent employment at the aggregated level of this industry was also very stable over time. After 16 years, the incumbents founded prior to 1975 still employed more than 96 percent of their initial workforce and after 27 years, almost half the initial workforce was still working in these businesses.

Figure 9 plots the similarity between the sectoral structure of entries and exits over time for the chemicals and plastics and textiles and leather industries.[3] Until 1987, the industry similarity between entries and exiting incumbents is higher in the textiles and leather industry than it is in chemicals and plastics. However, since 1988, the similarity within textiles and leather has decreased dramatically.

The pattern shown in Figure 9 is consistent with the pattern that results from sectoral similarity between entries and the initial sectoral structure in 1975. These two examples, the

[3] Similarity in chemicals and plastics is calculated at the level of regions using 16 industries, and similarity in textiles and leather is calculated using 30 industries. Similarity is calculated using the correlation coefficient similarity measure.

chemicals and plastics industry and the textiles and leather industry, provide some empirical evidence that the initial sectoral structure is of high importance for the sectoral structure of entries. However, whether region-specific knowledge has an effect on local ability to adjust through entries is a hypothesis that has not yet been investigated empirically.

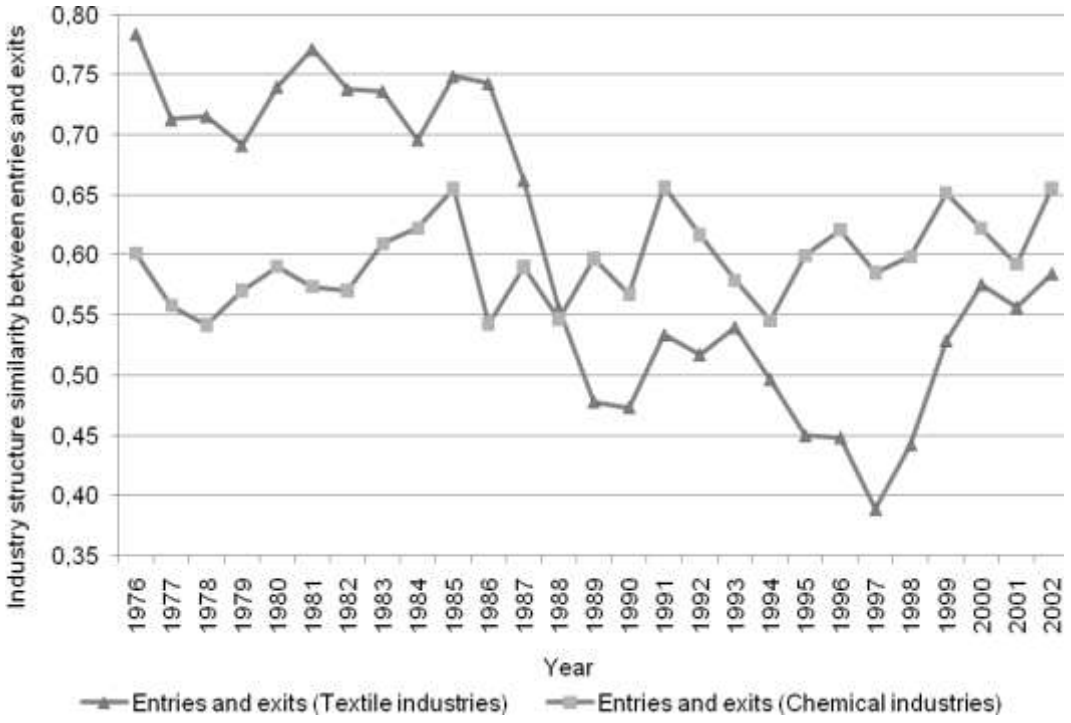


Figure 9: Industry similarity between entries and exits within the chemicals and plastics industry (16 different industries) and the textiles and leather industry (30 different industries)

No doubt other conditions are also of relevance in this process since an initial sectoral structure that allows a larger variety of entries in different fields can be expected to result in advantage during shocks and major changes, but may be less successful during more stable periods because of a lower degree of narrow specialization. The very best sectoral structure for promoting economic growth is probably one that enables quick adjustment to change as well as a

high degree of specialization. Whether such a sectoral structure now exists or can be built is another question altogether.

8 Conclusions and policy implications

This paper studied sectoral reallocations as one means for channeling entrepreneurial activity into economic growth. The empirical evidence suggests that structural change caused by entrepreneurial activity is positively related to economic growth. This finding supports the idea that entry can be an important way for countries and regions to actively adjust to necessary structural change. While initial sectoral structure appears to affect the sectoral similarity of entry (e.g., because of path dependency, industry-specific factors, and differences in the adaptability of technologies in different industries), there also appear to be pronounced regional differences in ability to adapt to structural change that cannot be entirely explained by a region's initial sectoral structure. This implies that supporting local entities that can ease the (unavoidable) change of sectoral structure may be useful in successfully managing (or directing) structural change. However, there is also some evidence that regions are limited in their ability to adjust due to the initial sectoral structure itself. This element of regional path dependency may depend on local knowledge that is shaped by the initial industries. Existing local resources, e.g., the regional knowledge base, thus can limit how much change new entries can make to the sectoral structure. A strategy of diversification or a focus on attracting industries that are themselves conducive to diversification might increase local ability to adjust in the case of shocks and could allow regions to escape negative lock-in effects. However, such a strategy might come at the cost of a relatively decreasing importance of those industries in which specialization is particularly profitable but the potential for diversification into other sectors is quite limited. Finding the right

balance between encouraging new entry so as to make a region more flexible in the face of change and encouraging entries that will profit from specialization will not be an easy task and the results, whether good or bad, will be long lasting. Caution and a case-by-case approach are recommended.

A deeper investigation into the dimensions and implications that entrepreneurial activity has for factor reallocation and structural change will result in better-informed policies. For example, is a strategy of more quickly disbanding existing structures superior for adjustment by new business formation compared to a strategy that calls for a slower adjustment? What can actually and practically be done to attract the sort of new entry that will enhance the flexibility to deal with change? Answering these and other questions will help local actors deal more successfully with structural change.

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Appendix:

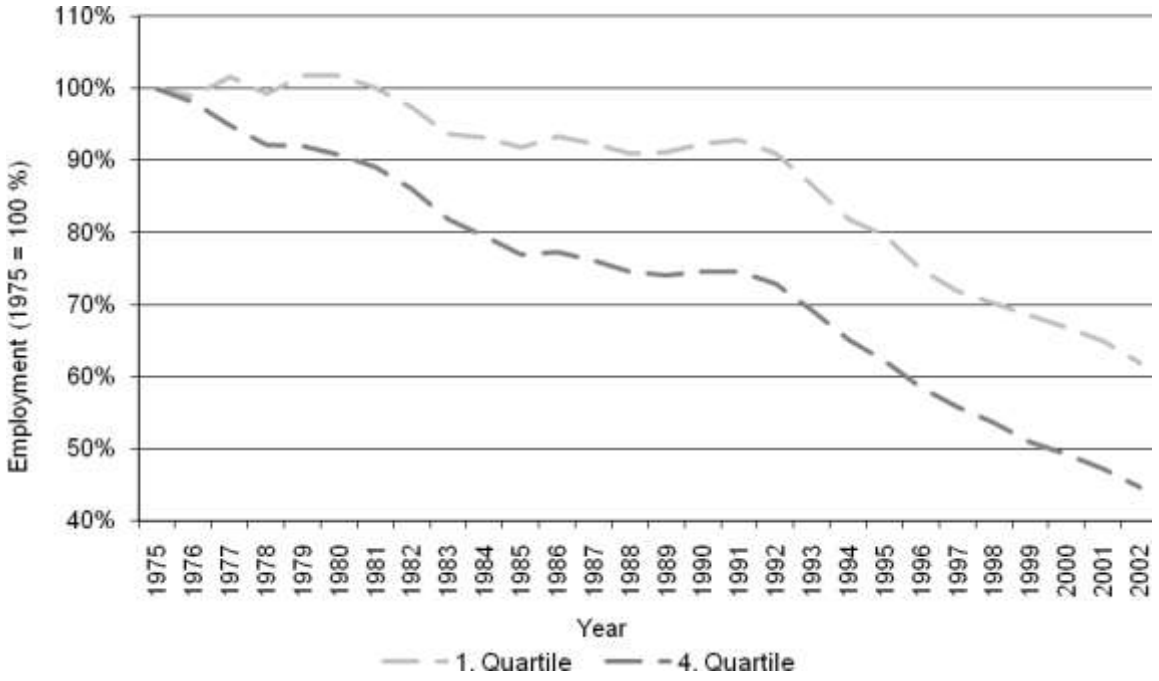

Figure A1. Employment development of businesses founded prior to 1976 (Q1: regions with 25% lowest similarity; Q4: regions with 25% highest similarity)

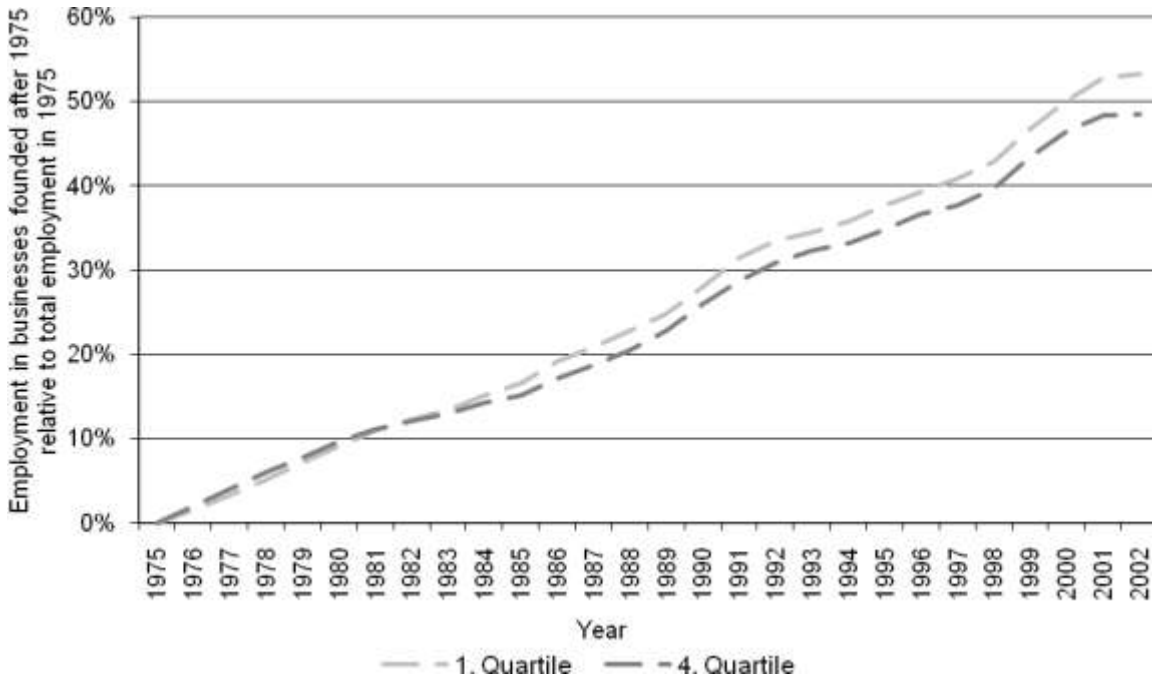

Figure A2. Employment development of businesses founded after 1975 relative to total employment in 1975 (Q1: regions with 25% lowest similarity; Q4: regions with 25% highest similarity)

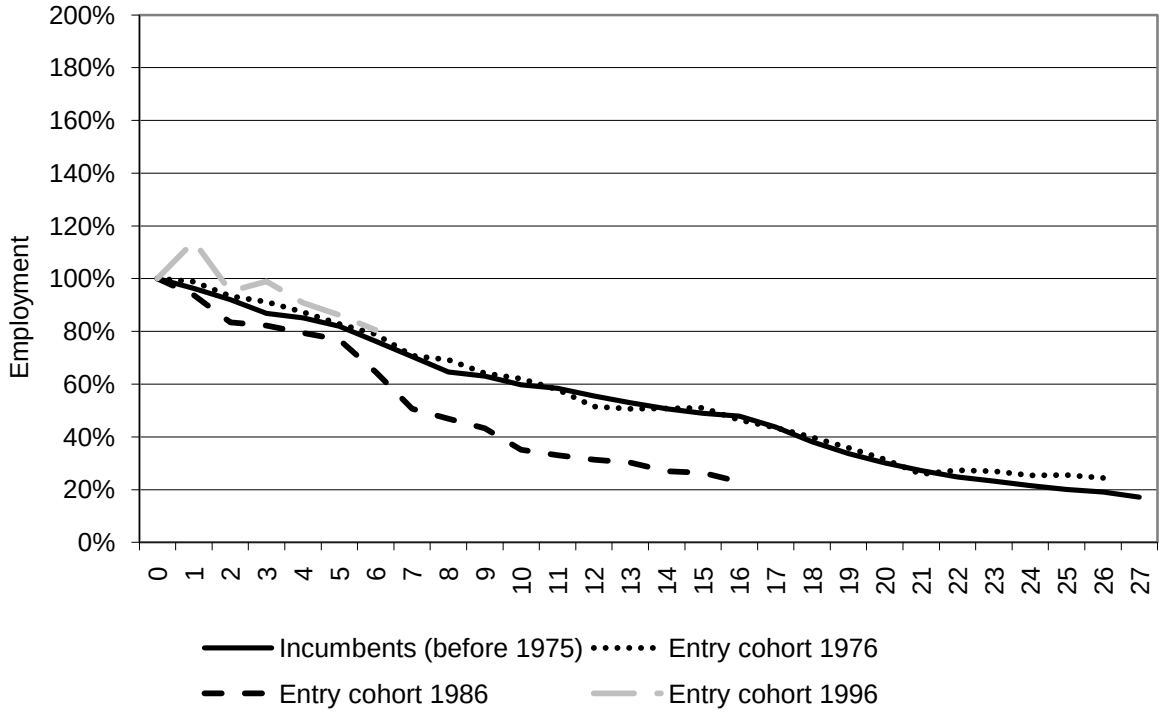

Figure A3. Employment development in the textiles and leather industry in incumbent businesses (founded prior to 1976) and entry cohorts 1976, 1986, and 1996

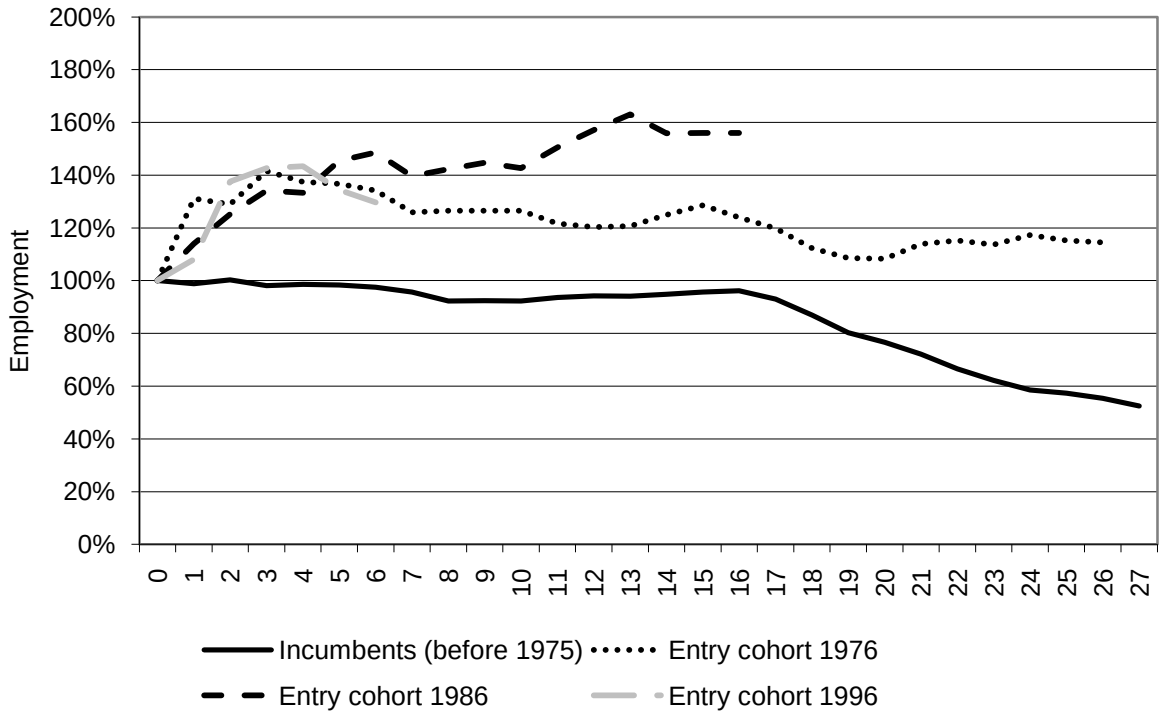

Figure A4. Employment development in the chemicals and plastics industry in incumbent businesses (founded prior to 1976) and entry cohorts 1976, 1986, and 1996

Table A1: Regression results for similarity measures based on all three-digit industries

Dependent variable: employment growth 1983–2002						
	(1)	(2)	(3)	(4)	(5)	(6)
–correlation coefficient	-0.340**	-0.256*	-0.377***	-0.296**	–	–
similarity measure (log)	(0.14)	(0.13)	(0.14)	(0.13)		
–cosine similarity	–	–	–	–	-0.366**	-0.288*
measure (log)					(0.17)	(0.16)
Start-up rate (log)	–	–	0.177***	0.174***	–	
			(0.064)	(0.052)		
Highly skilled employment	0.107***	0.121***	0.0943***	0.101***	0.105***	0.121***
share (log)	(0.030)	(0.031)	(0.030)	(0.029)	(0.031)	(0.031)
Population density (log)	-0.0540***	-0.0349**	-0.0551***	-0.0420***	-0.0548***	-0.0350**
	(0.012)	(0.014)	(0.012)	(0.015)	(0.012)	(0.014)
Market potential (log)	0.00772	0.0330	-0.00572	0.0314	0.00883	0.0337
	(0.028)	(0.031)	(0.027)	(0.031)	(0.028)	(0.031)
Small business	0.604***	0.782***	-0.115	-0.00964	0.607***	0.788***
employment share	(0.17)	(0.20)	(0.31)	(0.30)	(0.17)	(0.20)
Industry concentration	-0.544*	-0.815***	-0.512	-0.736**	-0.540*	-0.813***
(Gini)	(0.32)	(0.29)	(0.34)	(0.30)	(0.32)	(0.29)
Constant	0.840*	0.446	2.010***	1.404**	0.822*	0.435
	(0.47)	(0.47)	(0.59)	(0.55)	(0.47)	(0.47)
Control for industry composition	No	Yes	No	Yes	No	Yes
R^2	0.3528	0.5374	0.3721	0.5542	0.3500	0.5365

Note: Total employment growth is $\log(emp_{r,1998} / emp_{r,1983})$. New business similarity is the average similarity for the period 1976 to 1982 based on 292 industries. Columns 1 to 4 use the correlation coefficient similarity measure and Columns 5 and 6 the cosine similarity measure. All other independent controls are mean values for the period 1975 to 1982. Coefficients for the initial industry composition are omitted for the sake of brevity. OLS estimation with robust standard errors in parentheses. Significant at *** 1%, ** 5 %, * 10%. The number of observations is 326.

Table A2. Cross-section regression results for agglomerations only

Dependent variable: employment growth 1983–2002		
	(1)	(2)
– similarity between entries	-1.399***	–
and initial sectoral structure (log)	(0.45)	
– similarity between entries	–	-0.633***
and exits (log)		(0.22)
Highly skilled employment	0.226***	0.213***
share	(0.048)	(0.046)
Population density (log)	-0.110***	-0.105***
	(0.027)	(0.027)
Market potential (log)	0.0198	0.0425
	(0.059)	(0.057)
Small business	0.836**	0.628*
employment share	(0.34)	(0.33)
Industry concentration	-1.008*	-1.321**
(Gini)	(0.52)	(0.61)
Constant	2.296**	2.158**
	(0.98)	(0.98)
Control for industry composition	Yes	Yes
R^2	0.7273	0.7194

Note: Total employment growth is $\log(emp_{r,1998} / emp_{r,1983})$. New business similarity is the average correlation coefficient similarity measure for the period 1976 to 1982 based on 19 aggregated private industries (entries that survived at least five years). All other independent controls are mean values for the period 1975 to 1982. Coefficients for the initial industry composition are omitted for the sake of brevity. OLS estimation with robust standard errors in parentheses. Significant at *** 1%, ** 5 %, * 10%. The number of observations is 119.

Table A3. Usage of different similarity measures (similarity between entries and incumbents)

No. of industries	Similarity measure	Entries	Weights	Significant at
290 industries	correlation coefficient	5yrs	no weights	**
290 industries	correlation coefficient	5yrs	employment in t-1	**
max. 290 industries	correlation coefficient	5yrs	only industries with at least one entry	***
290 industries	correlation coefficient	5yrs	employment in 1975	*
290 industries	correlation coefficient	5yrs	employment in entries	***
290 industries	correlation coefficient	all entries	no weights	***
19 industries	correlation coefficient	5yrs	no weights	***
19 industries	correlation coefficient	5yrs	employment in t-1	**
max. 19 industries	correlation coefficient	5yrs	only priv. industries with at least one entry	***
19 industries	correlation coefficient	5yrs	employment in 1975	**
19 industries	correlation coefficient	all entries	no weights	***

Note: 5yrs denotes that only entries that survived at least five years have been used. Instead of the correlation coefficient similarity measure, the cosine similarity measure has been used. However, the general results did not change. Significant at *** 1%, ** 5 %, * 10%.

Table A4. Panel regression results for sectoral similarity between entries that survived at least five years and exits

	Dependent variable: yearly employment growth	
	All regions	Only urban areas with more than 500,000 inhabitants
	(1)	(2)
Sectoral similarity between entries	-0.0141***	-0.107***
and exits (log), t-1	(0.0047)	(0.038)
Highly skilled employment share, t-1	0.438***	0.891***
	(0.057)	(0.31)
Population density (log), t-1	0.0209	0.0343
	(0.014)	(0.052)
Market potential (log) , t-1	0.0414	-0.0585
	(0.036)	(0.12)
Small business employment share, t-1	0.763***	1.386***
	(0.028)	(0.21)
Industry concentration (Gini), t-1	-0.192***	-0.386**
	(0.036)	(0.19)
Constant	-1.128***	-0.149
	(0.39)	(1.31)
Time dummies	Yes	Yes
Control for initial industry composition	Yes	Yes
F-test	114.29	14.12
	(0.00)	(0.00)
R^2	0.4137	0.7197

Note: The estimation method is fixed effects regression. New business similarity is based on entries that survived at least five years. The number of observations in Column 1 is 8,150, in Column 2 the number of observation is 325 (13 regions). The regions used in Column 2 are Hamburg, Munich, Cologne, Hannover, Frankfurt, Essen Dortmund, Stuttgart, Duesseldorf, Bremen, Duisburg, Recklinghausen, and the Rhein-Sieg-Kreis. Significant at *** 1%, ** 5 %, * 10%.