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**Working Paper**

## Regional growth regimes revisited - the case of West Germany

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Regional Growth Regimes Revisited –  
The Case of West Germany

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### Abstract

Audretsch and Fritsch (2002) proposed two explanations for the mixed evidence regarding the relationship between new firm formation and regional development. Firstly, they found evidence for the existence of long time lags needed before the main effects of new firm formation on employment change become evident. Secondly, they suggested that regions may be characterized by different growth regimes in which new firms and entrepreneurship assume different roles and accordingly lead to different effects. This paper reports the results of re-estimating the main relationships investigated by Audretsch and Fritsch (2002) in a somewhat different way. One main difference is that we now have information on a longer time-period available and have chosen shorter time intervals for the analysis. This enabled us to investigate the transition between different types of growth regimes in further detail. Furthermore, our analysis is not on the level of planning regions but on the level of districts ('Kreise') and we have explicitly accounted for spatial autocorrelation in the analysis, which turns out to be highly relevant.

JEL-classification: M13, O1, O18, R11

Keywords: Regional growth, new firms, entrepreneurship, growth regimes, time lags.

### Zusammenfassung

#### *“Regionale Wachstumsregime nochmals analysiert – Der Fall Westdeutschland”*

Audretsch und Fritsch (2002) haben zwei Erklärungen für die unklare empirische Evidenz hinsichtlich des Einflusses von Gründungen auf die Regionalentwicklung vorgeschlagen. Erstens fanden sie Hinweise darauf, dass wesentliche Effekte der Gründungen auf die Arbeitsplatzentwicklung erst mit großer Zeitverzögerung wirksam werden. Und zweitens vermuten sie, dass Regionen durch unterschiedliche Wachstumsregime gekennzeichnet sind in denen Gründungen und Entrepreneurship unterschiedliche Rollen spielen und sie entsprechend unterschiedliche Wirkungen entfalten. Dieser Aufsatz berichtet von erneuten empirischen Analysen der von Audretsch und Fritsch (2002) untersuchten Beziehungen. Ein wesentlicher Unterschied besteht darin, dass Daten über einen längeren Zeitraum zur Verfügung stehen. Gleichzeitig wird eine Einteilung in kürzere Zeitintervalle gewählt, so dass sich die Übergänge zwischen verschiedenen Typen von Wachstumsregimen eingehender untersuchen lassen. Weiterhin führen wir die Analyse auf der Ebene von Kreisen und nicht für Raumordnungsregionen durch. Und wir kontrollieren explizit für räumliche Autokorrelation, die sich in den Schätzungen als recht bedeutsam erweist.

JEL-Klassifikation: M13, O1, O18, R11

Schlagworte: Regionalentwicklung, Unternehmensgründungen, Entrepreneurship, Wachstumsregime, Time Lags.

## **1. Introduction**

While it is a popular belief that a high level of new firm formation stimulates economic development (cf. section 2) the empirical evidence for this relationship is rather diffuse. Audretsch and Fritsch (2002) proposed two explanations for this unclear evidence. Firstly, there are perhaps relatively long time lags needed for the main effects of new firm formation to become evident. Secondly, they suggested that regions may be characterized by different growth regimes in which new firms and entrepreneurship assume different roles and accordingly lead to different effects. Based on a classification of West German regions into four types of growth regimes in the 1980s and the 1990s, they concluded that the type of regional growth regime may change over time. Likewise, the whole West German economy appears to have become more entrepreneurial in the 1990s as compared to the 1980s (Audretsch and Fritsch, 2003).

This paper reports the results of re-estimating the main relationships investigated by Audretsch and Fritsch (2002) in a somewhat different way. One main difference is that we have chosen shorter time intervals for the analysis. Furthermore, our analysis is not on the level of planning regions but on the level of districts ('Kreise') and we have explicitly accounted for spatial autocorrelation in the analysis, which turns out to be highly relevant. Another main difference is that we were able to analyze a longer time period than was used by Audretsch and Fritsch (2002). At first we provide some basic information on the data and on measurement issues (section 2). The results of our analysis of how the relationship between the level of new firm formation and employment changes in different time periods are reported in section 3. Section 4 deals with the classification of the different growth regimes and their regional distribution in different time periods. In section 5 we analyze the transition of regional growth regimes over time. Finally, we draw some conclusions for policy and for further research (section 6).

## **2. Data and measurement issues**

Our information on new firm formation and regional employment is from the establishment file of the German Social Insurance Statistics, as described and documented by Fritsch and Brixey (2004). This source currently provides data for the time period from 1983-2002. Other data used in the analysis are from publications of the German Federal Statistical

Office ('Statistisches Bundesamt'). Following the example of Audretsch and Fritsch (2002), we have restricted our analysis to West Germany because many studies indicate that East Germany in the 1990s was a special case with very specific conditions that cannot be directly compared to West Germany (cf. Brixy and Grotz, 2004; Fritsch, 2004). The Berlin region was excluded due to changes in the definition of that region during the time period under inspection. In contrast to Audretsch and Fritsch (2002), we used districts ('Kreise') instead of planning regions as units of analysis. Districts are considerably smaller than planning regions: the 74 planning regions of West Germany consist of 326 districts. While planning regions are functional spatial units that consist of at least one core city and the surrounding area districts can be much more different in character; some are core cities, others are part of an agglomeration's suburban ring and some comprise the core of a smaller city as well as the surrounding area. The advantage of choosing districts as spatial units of analysis is found in the higher number of cases in the empirical model that allows for more sophisticated analysis. A severe disadvantage could be that certain influences prove to be relevant for larger units and not just for individual districts, resulting in spatial autocorrelation. We have indeed found quite a considerable degree of spatial autocorrelation that we explicitly account for in our analysis.

The analysis of Audretsch and Fritsch (2002) is based on a distinction of two time intervals labeled as the 1980's (1983-89) and the 1990's (1993-98). In order to analyze the transition of growth regimes over time in some more detail we have chosen shorter time intervals of five years: 1983-87, 1988-92, 1993-97 and 1998-2002.<sup>1</sup> To analyze the impact of new firm formation on economic development in a certain time period we related the average start-up rate of the first two years to relative employment change (percentage) of the whole period. We do so in order to limit the effect of the initial employment that new firms create on employment change in the time-period under inspection. Relating employment change over a five year period to start-up rates in the first two years gives more weight to the longer-term effects that new firms generate in the year after they have been set up. The start-up rate is calculated according to the "labor market" approach, i.e. the number of start-ups is divided by the number of persons in the regional workforce at the beginning of the respective period.<sup>2</sup>

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<sup>1</sup> Note that information about the years 1999-2002 was not available for the analysis of Audretsch and Fritsch (2002).

<sup>2</sup> See Audretsch and Fritsch (1994) for different approaches of calculating start-up rates.

An important adjustment was made to control for the fact that not only does the composition of industries vary considerably across regions, but the relative importance of start-ups and incumbent enterprises also varies systematically across industries. For example, start-up rates are higher in the service sector than in manufacturing industries. This means that the relative importance of start-ups and incumbents in a region is affected by the composition of industries in that region. This would result in a bias of overestimating the level of entrepreneurship in regions with a high composition of industries where start-ups play an important role and underestimating the role of new firm formation in regions with a high composition of industries where firm start-ups are relatively unimportant. To correct for the confounding between the regional composition of industries with the relative importance of start-ups and incumbent enterprises, a shift-share procedure was deployed to develop a measure of sector-adjusted start-up activity (see the Appendix of Audretsch and Fritsch, 2002 for details). This sector-adjusted number of start-ups is defined as the number of new firms in a region that can be expected to arise if the composition of industries was identical across all regions. The measure thus adjusts the raw data by imposing the same composition of industries on each region. Our analysis shows that this procedure leads to somewhat clearer results and higher levels of determination as compared to estimations using the non-adjusted start-up rate. However, the basic relationships are left unchanged.

### **3. The effect of new firm formation on regional employment over time**

Audretsch and Fritsch (2002) found that new firm formation contributed to regional employment in West Germany in the 1990s but not in the 1980s. This indicates that the effect of new firm formation on regional employment may vary over time. Moreover, Audretsch and Fritsch (2002) identified some significant long-term effects of new firm formation. Particularly, they found that the level of start-ups in the 1980s could contribute to explaining employment change in the 1990s, despite the lack of a relationship with employment change in the same time period. They concluded that considerable time lags may be needed for the main effects of new firm formation to become evident.

Regression analyses of the impact of new firm formation on regional employment change in the same time period confirm the result of Audretsch and Fritsch (2002), that this effect may be significantly positive but that it may also vary over time (table 1). A positive relationship between new firm formation and regional employment change can be ob-



served for the 1983-87, the 1988-92 and the 1993-97 periods. The effect is somewhat stronger in the 1993-97 period, however it is significantly negative in the fourth time period under inspection, namely 1998-2002. This result suggests that the relationship between entrepreneurial activity and regional employment change may also be negative. An explanation for such a negative impact of new firm formation could be that crowding-out of inefficient suppliers results in higher productivity of market supply (Fritsch and Mueller, 2004).

In our regressions we have used population density as a catch-all variable to account for all kinds of regional influences, such as availability of qualified labor, house prices, local demand, and the level of regional knowledge spillovers. The advantage of using the variable population density instead separated indicators for the regional characteristics is that problems of multicollinearity are avoided. The significantly negative coefficient for population density in the 1988-1992 and the 1993-1997 period of analysis indicates unfavorable conditions for employment in urbanized areas that leads to regional decentralization (suburbanization).

We found a quite pronounced degree of spatial autocorrelation in our data, i.e. employment change in adjacent regions is not independent but rather related in some way. As there are two possible reasons for spatial autocorrelation, we control for spatial autocorrelation in two different ways. Firstly, the effect of the factors responsible for employment change may not be limited to the particular region but may spill over to other regions. We accounted for this type of spatial autocorrelation by including a weighted average of the district's employment change in the adjacent regions. A second type of spatial autocorrelation of regional employment change could be caused by influences that affect larger geographical entities than districts and which are not fully reflected in the explanatory variables of the model. We accounted for this type of spatial autocorrelation by including a weighted average of the residuals in the adjacent regions in our models. Remarkably, we arrive at diverging signs for the two types of spatial autocorrelation. While the spillovers from the adjacent regions have a positive effect on employment change, the effect of the residuals in the adjacent regions is strongly negative. Judged by the t-values of the respective coefficients, both types of effects are relatively strong, indicating a high relevance of spatial autocorrelation. The spillover effect tends to be a little more pronounced, but this difference appears negligible (cf. table 1).

*Table 1: Short-term effects of new firm formation on regional employment change in four time periods*

	Regional employment change (percentage)			
	1983 – 1987	1988 – 1992	1993 – 1997	1998 – 2002
Constant	-4.732** (4.59)	0.099 (0.06)	-6.345** (5.34)	-1.490 (1.67)
Average sector-adjusted start-up rate 1998/99	-	-	-	-0.179* (2.08)
Average sector-adjusted start-up rate 1993/94	-	-	0.638** (5.70)	-
Average sector-adjusted start-up rate 1988/89	-	0.374** (4.12)	-	-
Average sector-adjusted start-up rate 1983/84	0.173* (2.07)	-	-	-
Population density	0.000 (0.45)	-0.002** (4.51)	-0.001** (4.05)	-0.000 (0.62)
Employment change (%) in adjacent regions	1.707** (16.18)	0.758** (6.28)	0.570** (4.77)	2.152** (18.32)
Spatial autocorrelation (residuals in adjacent regions)	-1.992** (12.13)	-0.511** (3.14)	-0.365* (2.12)	-2.640** (14.33)
R <sup>2</sup> adjusted	0.495	0.353	0.346	0.520
F value	80.70	45.38	44.04	89.03
No. of cases	326	326	326	326

*Notes: T-values in parentheses.*

*\* Statistically significant at the 5%-level, \*\* statistically significant at the 1%-level.*

*population density of 1984 in period 1983-1987 and 1988-1992, population density of 1992 in period 1993-1997, population density of 1998 in period 1998-2002.*

As the next step of the analysis we have included start-up rates of preceding time periods in order to shed some light on the question as to whether there are long-term effects of new firm formation on regional employment change (table 2). We have done this in two ways. Firstly, we have included all relevant start-up rates (current and preceding) into one model. Secondly, we have run the regressions for each of the start-up rates separately. The differences between the two approaches indicate a high correlation between the start-up rates of the different time periods. Indeed, the respective correlation coefficients are rather high (cf. table A1 in the Appendix). The results of the regressions with the separate start-up rates confirm the finding of Audretsch and Fritsch (2002) that new firm formation in earlier periods may have a strong impact on employment change. This indicates that there are considerable time lags relevant here.

Table 2: Long term effects of new firm formation in four time intervals

	Regional employment change, 1988-1992 (%)			Regional employment change, 1993-1997 (%)				Regional employment change, 1998-2002 (%)				
Constant	-0.069 (0.04)	0.192 (0.12)	-0.103 (0.06)	-7.138** (6.39)	-6.345** (5.34)	-6.210** (5.73)	-7.779** (7.13)	-0.633 (0.67)	-1.490 (1.67)	-1.554 (1.86)	-1.803* (2.21)	-1.951* (2.46)
Average sector- adjusted start-up rate 1998/99	-	-	-	-	-	-	-	-0.526* (2.14)	-0.179* (2.08)	-	-	-
Average sector- adjusted start-up rate 1993/94	-	-	-	-0.421 (1.58)	0.638** (5.70)	-	-	0.394 (1.20)	-	-0.170 (1.75)	-	-
Average sector- adjusted start-up rate 1988/89	0.080 (0.35)	0.373** (4.11)	-	0.007 (0.03)	-	0.608** (6.29)	-	0.003 (0.01)	-	-	-0.134 (1.59)	-
Average sector- adjusted start-up rate 1983/84	0.341 (1.42)	-	0.419** (4.43)	1.088** (4.17)	-	-	0.751** (7.62)	0.019 (0.08)	-	-	-	-0.125 (1.41)
Population density	-0.001** (3.96)	-0.002** (4.49)	-0.001** (3.92)	-0.010** (2.83)	-0.001** (4.05)	-0.001** (4.02)	-0.001** (3.00)	0.000 (0.23)	-0.000 (0.62)	-0.000 (0.84)	-0.000 (0.76)	-0.000 (0.77)
Employment change (%) in adjacent regions	0.734** (6.06)	0.752** (6.21)	0.737** (6.06)	0.536** (4.97)	0.570** (4.77)	0.572** (4.95)	0.511** (4.71)	1.771** (15.54)	2.152** (18.32)	2.048** (17.01)	2.04** (16.92)	2.062** (17.07)
Residuals in adjacent regions	-0.475** (2.88)	-0.501** (3.08)	-0.481** (2.90)	-0.452** (2.68)	-0.365* (2.12)	-0.409* (2.42)	-0.383* (2.27)	-2.071** (11.94)	-2.640** (14.33)	-2.484** (13.25)	-2.49** (13.11)	-2.535** (13.41)
R <sup>2</sup> adjusted	0.353	0.353	0.355	0.401	0.346	0.367	0.395	0.474	0.520	0.496	0.494	0.501
F value	36.45	45.29	45.63	37.21	44.04	48.14	53.96	42.83	89.03	81.02	80.28	82.71
No. of cases	326	326	326	326	326	326	326	326	326	326	326	326

Notes: *T-values in parentheses*

\* Statistically significant at the 5%-level; \*\* statistically significant at the 1%-level;

population density of 1984 in period 1988-1992, population density of 1992 in period 1993-1997, population density of 1998 in period 1998-2002.

It is particularly remarkable that in some of the models we have found a significantly negative effect of new firm formation on regional employment in the same time period. Again, this indicates that the relationship between new firm formation and regional employment change may also be negative. The negative relationship may reflect the crowding out of inefficient suppliers resulting in higher productivity of market supply (Fritsch and Mueller, 2004).

As in the analyses that were limited to the start-ups of the same period (table 1), population density has a significantly negative impact on regional employment change in the 1988-1992 and the 1993-1997 periods under inspection. Again, the inclusion of both measures of spatial autocorrelation has resulted in diverging sign for the two types; the spillovers from the adjacent regions have a positive effect on employment change while the effects of the residuals in the adjacent regions are strongly negative (cf. table 2).

#### **4. The regional distribution of growth regimes**

Audretsch and Fritsch (2002) suggested that the role of new firms and entrepreneurship may not be identical in all regions but that there are differences in the impact of new firm formation on regions. In introducing a theory of growth regimes, they extended the concept of the technological regime (Audretsch, 1995, 39-64; Marsili, 2002; Winter, 1984) from the unit of observation of the industry to a geographic unit of observation. By analogy, the entrepreneurial growth regime exists in a region where growth is the result of high importance of new-firm start-ups and turbulent enterprise structure. In contrast, a routinized growth regime exists in a region where growth is the result of a stable enterprise structure and the predominance of large, incumbent enterprises. In the routinized regime, firm start-ups play a relatively unimportant role, and if new firms do enter the market their chances for survival and growth are much lower than in an entrepreneurial regime. Audretsch and Fritsch (2002) characterized regions which exhibit relatively low growth rates but high start-up rates as revolving-door regimes. They suspected that under such a regime entries tend to be non-innovative, supplying basically the same products using about the same technology as the incumbent firms. Finally, low-growth regions exhibiting little start-up activity are classified as belonging to a downsizing regime. The relatively low level of start-up activity here is insufficient to provide enough new jobs or income to substitute for the losses in the incumbent firms.

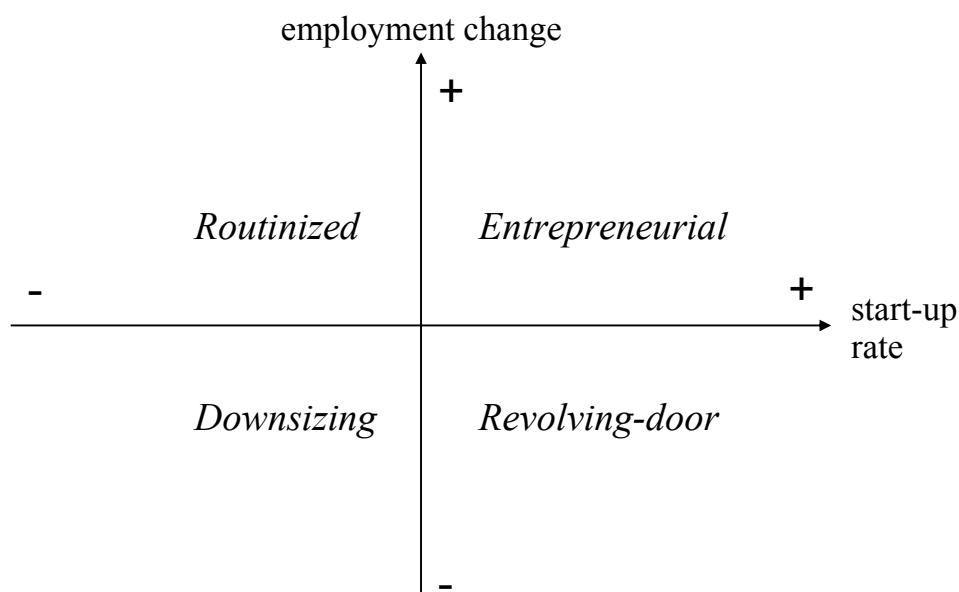


Figure 1: Growth regime types and their characteristics

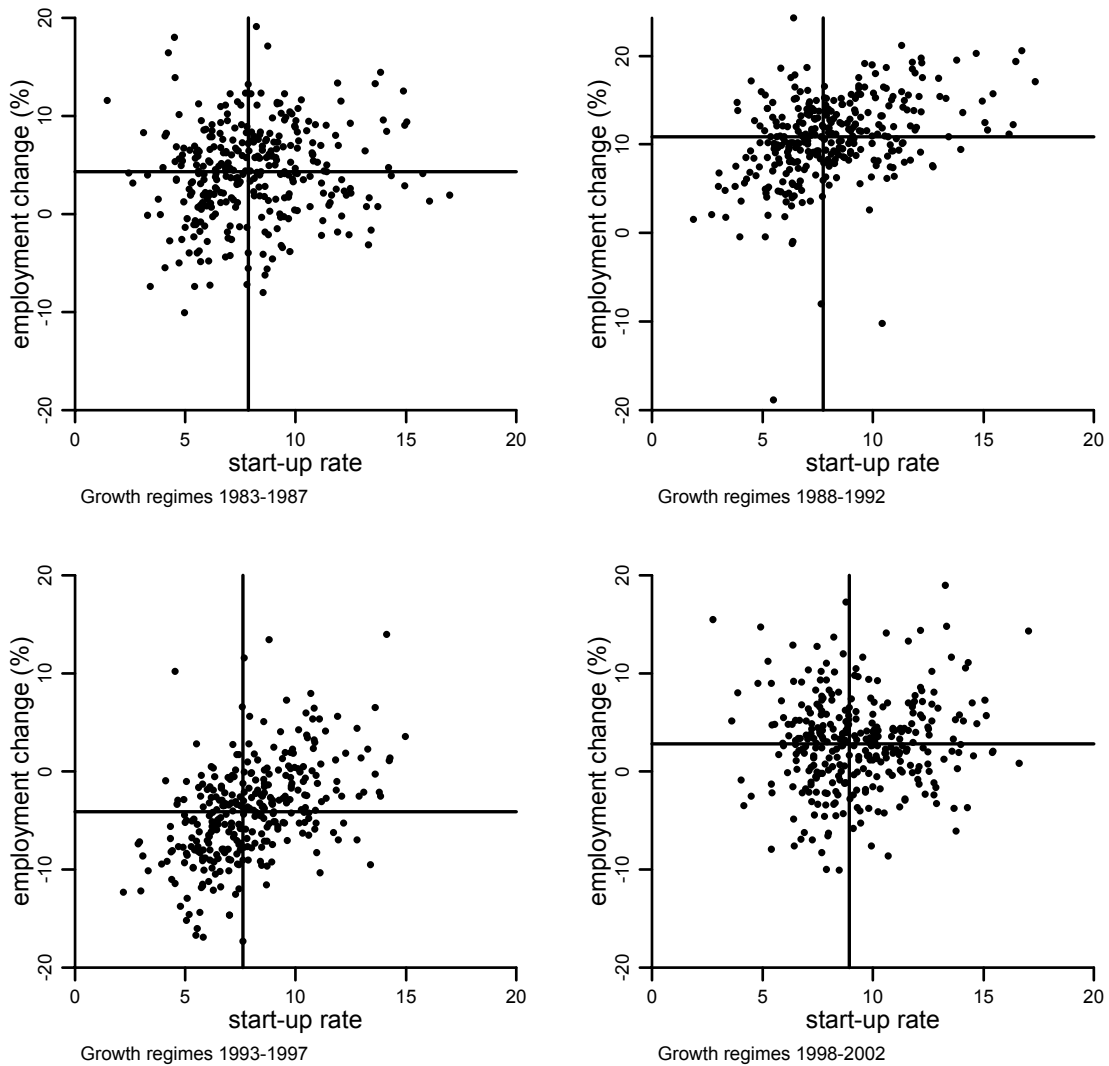
Table 3: Distribution of growth regime types over time

	1983-1987	1988-1992	1993-1997	1998-2002
Growth regime type:				
Entrepreneurial <sup>1</sup>	88	102	112	88
Revolving-door <sup>1</sup>	75	61	51	75
Routinized <sup>1</sup>	75	61	51	75
Downsizing <sup>1</sup>	88	102	112	88
Growth regime characteristics:				
Employment change <sup>2</sup>	4.19%	10.83%	-4.12%	2.82%
Start-up rate <sup>2</sup>	7.86	7.73	7.63	8.93

Notes: <sup>1</sup> Number of districts, <sup>2</sup> median values

We have classified all 326 West German districts either as an entrepreneurial regime, a revolving-door regime, a routinized regime or a downsizing regime for each of the four periods of analysis. The classification of each district is based upon its start-up rate and employment growth rate. If both the start-up rate and the employment growth rate exceed their median values they are regarded as having an entrepreneurial regime. A district is classified a revolving-door regime if the start-up rate exceeds the median value but the employment

growth rate is below the median value. A routinized regime is based upon a start-up rate below its median value and an employment growth rate exceeding the median value. Finally, the downsizing regime exists when both rates are below the median values (cf. figure 1).



Note: Lines represent median values of start-up rate and employment change.

*Figure 2: Distribution of growth regime types over time*

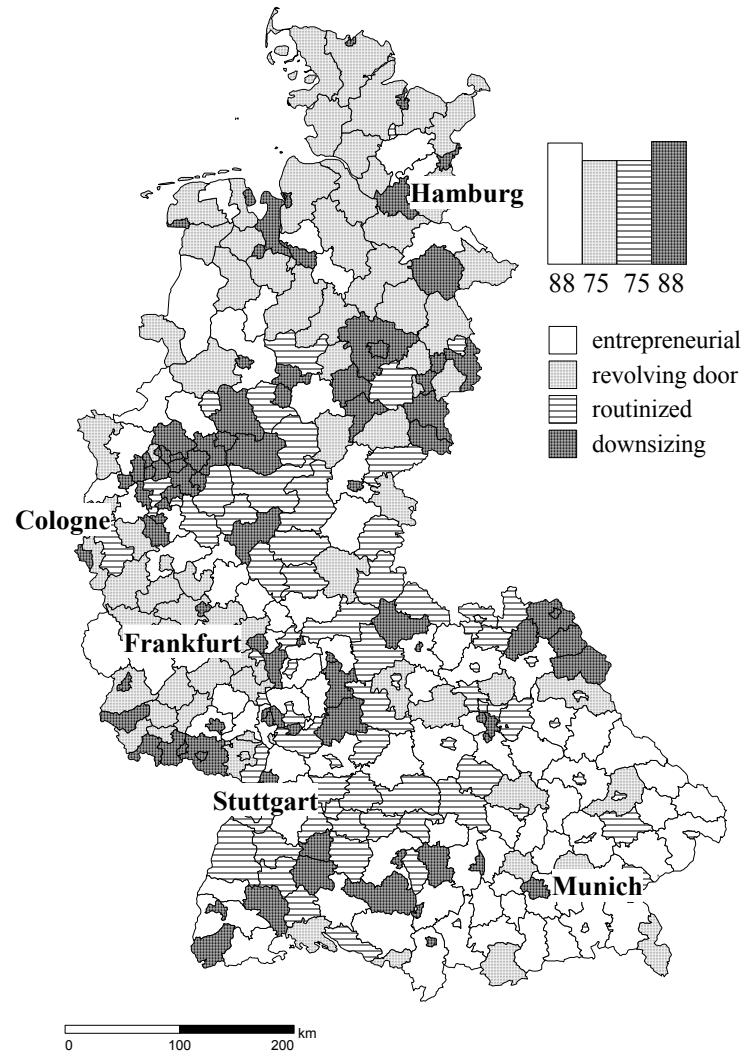
An inspection of the distribution of growth regimes in the four periods has shown, that all four types are rather evenly distributed in the first and last period (1983-1987 and 1998-2002); in both of these periods 88 districts are classified as either entrepreneurial or downsizing regimes compared to 75 districts that are classified as either revolving-door or

routinized regime types. The distribution of growth regime types in the 1988-1992 and 1993-1997 periods is somewhat concentrated on the entrepreneurial and downsizing regime.

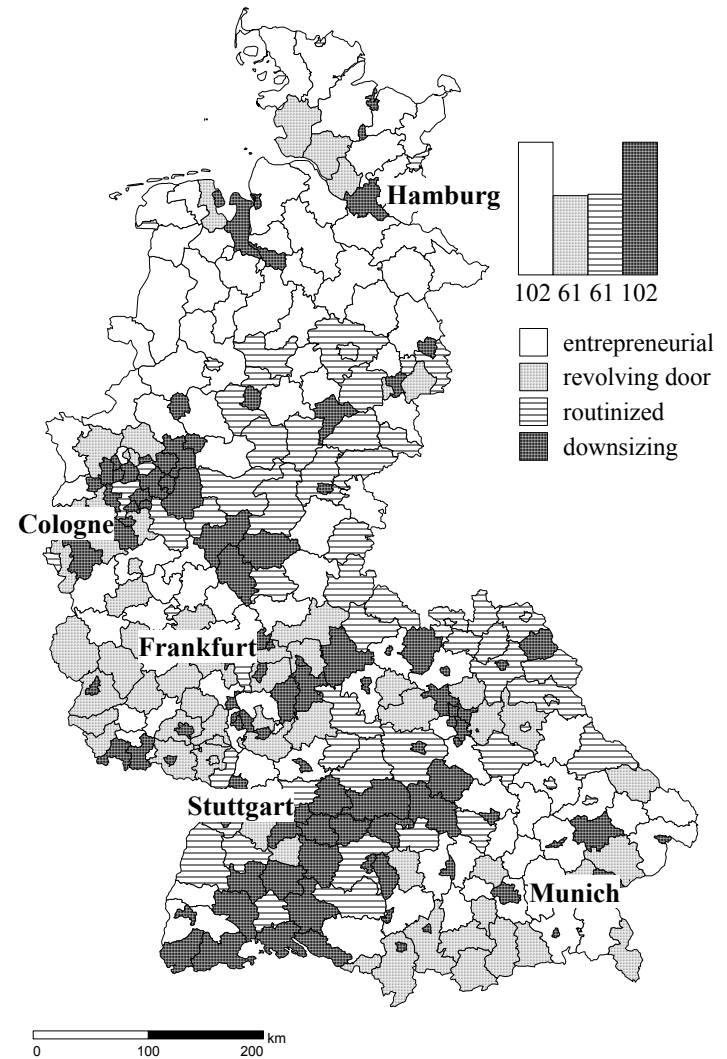
Between 1993 and 1997 about twice as many districts are classified as either entrepreneurial (112) or downsizing regimes (112) compared to those districts classified as revolving-door (51) or routinized regimes (51) (cf. table 3 and figure 2).

Classifying the West German districts into these four types of growth regimes (figure 3 to 6) shows no evidence of an erratic patchwork-pattern but rather illustrates that neighboring districts are often classified as the same growth regime type. This confirms the significant impact that we have found for spatial autocorrelation in the regression analyses reported in section 3. In all four periods the regions with above average start-up rates are concentrated in the northern part of the country (Schleswig-Holstein and the northern part of Lower Saxony) and in the Southwest (Bavaria). However, because the regions of Bavaria are more often classified as entrepreneurial they seem to be more successful in transforming new firm formation into growth. Comparing the different time periods of analysis it is remarkable to note that quite a number of revolving-door regions become entrepreneurial in the following period and vice-versa. There are also remarkably prevalent transitions from a routinized regime to a downsizing regime. This can be quite frequently observed in regions in South-Lower Saxony, the Rhine-Ruhr area and parts of Baden-Wurttemberg.

It is noticeable that most of the large cities (Hamburg, Munich, Frankfurt, and Düsseldorf) are classified as either routinized or even downsizing regimes throughout all four time periods. However, a closer inspection reveals that adjacent districts of these metropolitan areas are classified quite differently. For example, the neighboring districts to Munich and the districts belonging to the same planning region are characterized by high start-up rates and are mostly classified as entrepreneurial regimes. The same pattern can be seen for Hamburg and the surrounding districts. While Hamburg itself is classified as downsizing in the first three sub-periods and routinized in the last period, all of the adjacent regions are characterized by high start-up rates and are mostly classified as entrepreneurial regimes.

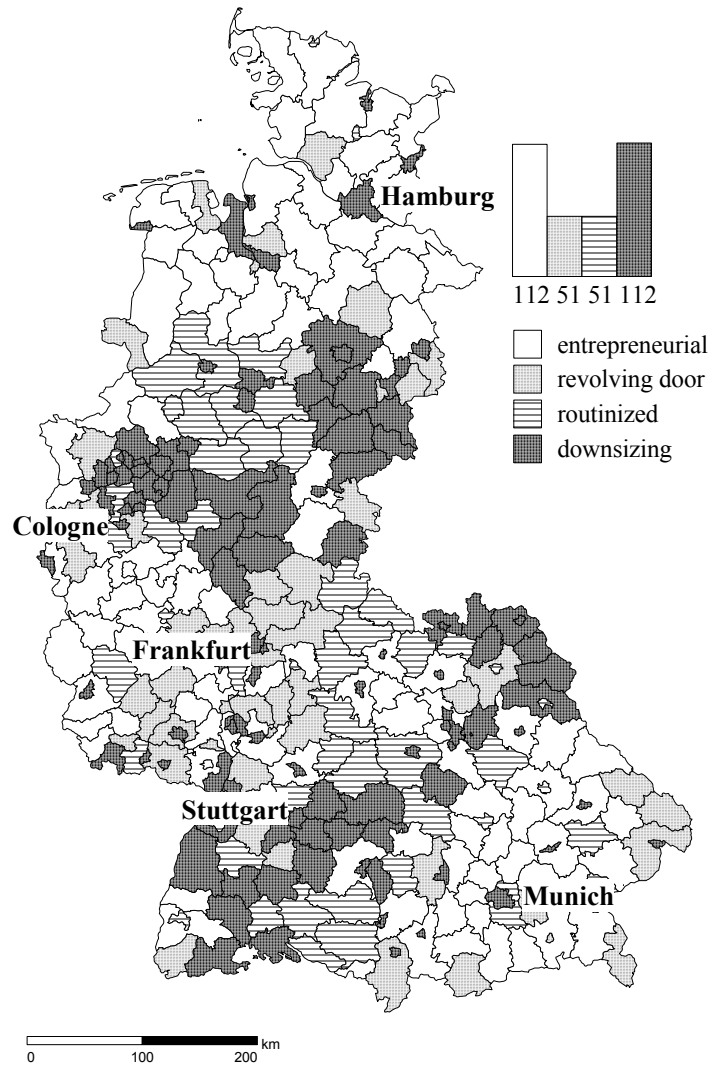


*Figure 3: Distribution of regional growth regimes in West Germany, 1983-1987*

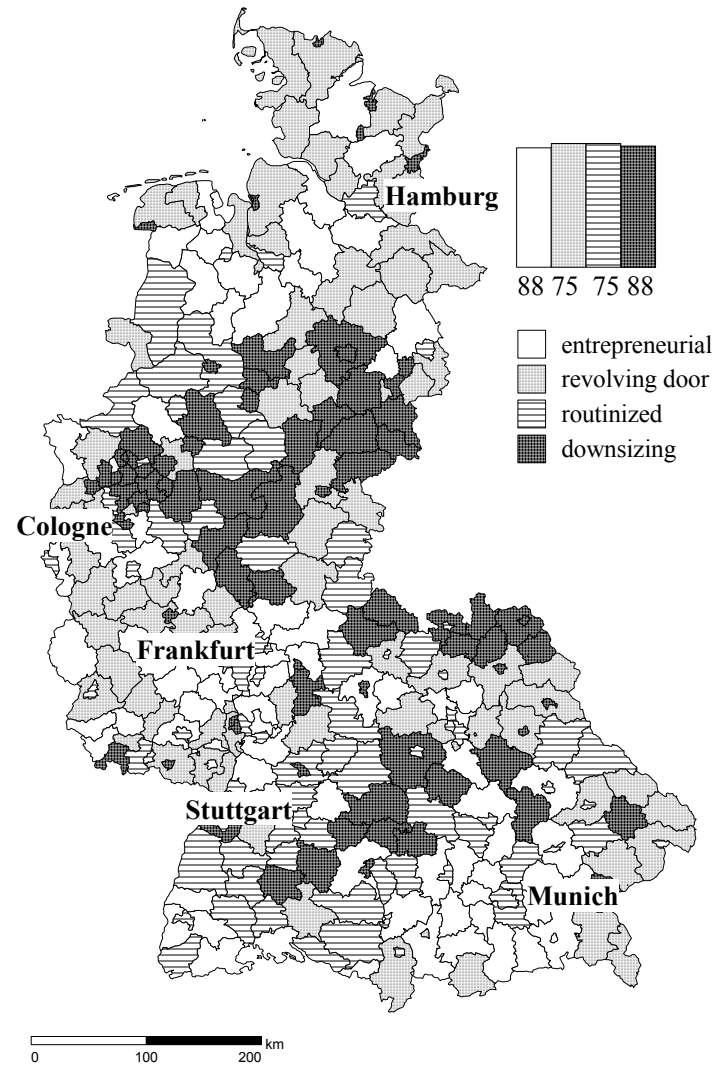


*Figure 4: Distribution of regional growth regimes in West Germany, 1988-1992*





*Figure 5: Distribution of regional growth regimes in West Germany, 1993-1997*



*Figure 6: Distribution of regional growth regimes in West Germany, 1998-2002*

Another interesting example of a region dominated by a larger city is Stuttgart. In the case of Stuttgart, the core city as well as the adjacent districts tend to be of the same type of growth regime. In the 1983-87 period the city of Stuttgart and all the adjacent districts are classified as routinized. In the following two periods nearly all of these districts are downsizing and in the final period of 1998-2002 most of the districts are routinized. Remarkably, one of the surrounding districts has managed to become entrepreneurial in this last period – after at least 15 years of a below-average level of start-up activity. Looking finally at the Ruhr area we have found core cities like Duisburg, Essen, Dortmund, and Hagen, as well as many of the surrounding districts, classified as downsizing regimes throughout all four periods of the analysis. This may be understood as indicating a lack of structural adjustment.

The inspection of other factors that may stimulate relatively high employment growth indicates that regions with an entrepreneurial or a routinized regime are characterized by high growth rates of gross value added and by high growth rates of gross value added per employee of the district. However, a high number of R&D personnel and a high number of employment growth seem to be unrelated. Furthermore, a high amount capital investment also does not explain employment growth.

## **5. Transitions of regional growth regimes over time**

By looking at the transitions between the different types of growth regimes we could find certain patterns that occur much more frequently than others. Changes are concentrated either between the entrepreneurial and the revolving-door or between the routinized and the downsizing regimes. However, a relatively high share of districts also remains categorized as the same type of growth regime in the following time period. This holds particularly true for the regions with an entrepreneurial regime and for the regions with a downsizing regime.

*Table 4: Distribution of regions across regimes, transition probabilities between all four time periods*

	Growth regime type									
	Entrepreneurial		Revolving-door		Routinized		Downsizing		Row Total	
	Cases	%	Cases	%	Cases	%	Cases	%	Cases	%
Entrepreneurial	52	59.09	23	26.14	9	10.23	4	4.55	88	100
	73	71.57	18	17.65	8	7.84	3	2.94	102	100
	60	53.57	39	34.82	10	8.93	3	2.68	112	100
		61.41		26.20		9.00		3.39		
Revolving-door	43	57.33	28	37.33	3	4.00	1	1.33	75	100
	32	52.46	24	39.34	2	3.28	3	4.92	61	100
	16	31.37	31	60.78	2	3.92	2	3.92	51	100
		47.05		45.81		3.73		3.39		
Routinized	0	0.00	3	4.00	30	40.00	42	56.00	75	100
	5	8.20	3	4.92	25	40.98	28	45.90	61	100
	0	0.00	3	5.88	31	60.78	17	33.33	51	100
		2.73		4.93		47.25		45.08		
Downsizing	7	7.95	7	7.95	19	21.59	55	62.50	88	100
	2	1.96	6	5.88	16	15.69	78	76.47	102	100
	4	3.57	10	8.93	40	35.71	58	51.79	112	100
		4.49		7.59		24.33		63.59		
Column Total	102	31.28	61	18.71	61	18.71	102	31.28	326	100
	112	34.36	51	15.64	51	15.64	112	34.36	326	100
	80	24.54	83	25.46	83	25.46	80	24.54	326	100

*Note:* First row: change between 1983-87 and 1988-92;  
second row: change between 1988-92 and 1993-97;  
third row: change between 1993-97 and 1998-2002;  
fourth row: average transition probability.

Taking all transitions between successive time periods together, we have found that on average 61.41 percent of the districts with an entrepreneurial regime stay in this category during the following time period. The probability of staying entrepreneurial is more than twice as high as becoming revolving-door in the subsequent time period. Regions classified as a revolving-door regime have about the same probability of shifting towards an entrepreneurial regime or remaining in the revolving-door category in the following period (on average 47.05 percent and 45.81 percent respectively). Districts with a downsizing regime show the highest degree of persistence, with an average 63.59 percent staying the same in the successive period. The probability of a district with a downsizing regime becoming routinized is only about half as large as the probability of a district with a routinized regime becoming a downsizing regime. For both routinized and downsizing regimes we have found the lowest probability for a transition to an entrepreneurial regime. If the low level of new firm forma-

tion activity that characterizes the routinized and the downsizing regimes is overcome, these regions are quite likely to first fall into the revolving-door category before they can benefit from the employment-generating effects of new firm formation and become entrepreneurial regimes (cf. table 4 and figure 7).

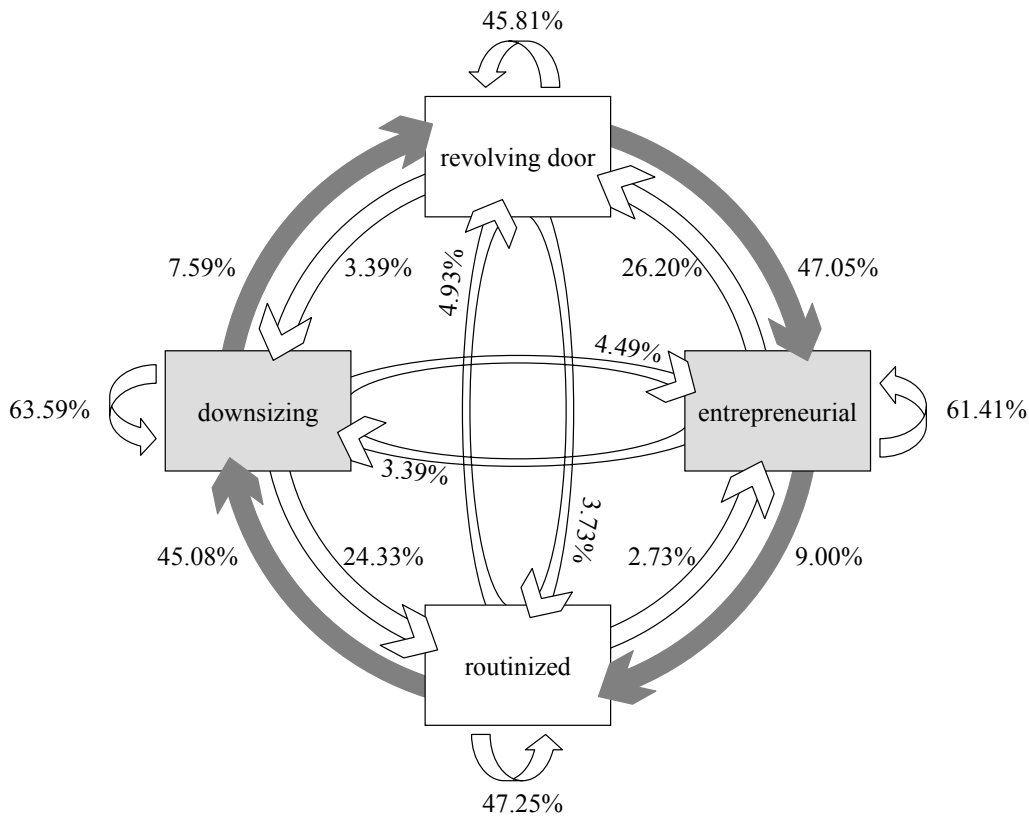


Figure 7: Change of growth regime types

Looking at the persistence times of the different types of growth regimes we have found certain patterns that occur more frequently than others. Districts have an entrepreneurial or a downsizing regime for about 10.51 and 10.82 years respectively. The classification as a revolving-door or a routinized regime on average lasts merely 7.77 and 7.83 years respectively. A rather high number of districts are classified as entrepreneurial (19) or downsizing regimes (24) throughout all four time periods. However, this steadiness cannot be observed for the revolving-door and routinized regime: only 7 districts stay a revolving-door regime and 11 districts stay a routinized regime in all four time periods of our analysis. These regimes are mostly retained for only five or ten years.

Taken together, the entrepreneurial and the revolving-door regimes and the routinized and the downsizing regimes have led to an average persistence time of about 16 years. About 130 of 326 districts have accounted for relatively high start-up rates over the 20 year period of our analysis. An opposite pattern can also be seen, as 128 of 326 districts are characterized by low start-up activity for at least 20 years (cf. table 5).

*Table 5: Persistence times of growth regime types*

Growth regime type	Persistence time per growth regime				Average
	5 years	10 years	15 years	20 years	
Entrepreneurial	58	54	37	19	10.51
Revolving-door	93	38	12	7	7.77
Routinized	96	37	8	11	7.83
Downsizing	56	49	35	24	10.82
Entrepreneurial and/or revolving-door	34	19	15	130	16.09
Routinized and/or downsizing	27	26	15	128	16.22

*Note:* Multiple counting of districts.

Further geographical inspection shows that half of the districts categorized as entrepreneurial regimes over all four time periods are located in Bavaria and half of the districts that are classified as downsizing regimes for at least 20 years are concentrated in North Rhine Westphalia. The districts with routinized growth regimes are geographically centered in Baden-Wuerttemberg. One example is the medical technology cluster in the region of Tuttlingen, which is the recognized world leader in the global surgical instruments industry (Halder, 2003). An examination of the persistence times suggests that the revolving-door regime functions as an intermediate stage before a region becomes an entrepreneurial regime. The routinized regime is also subject to relatively short persistence times and a typical pre-stage of becoming a downsizing regime (cf. table 5).

Our results indicate a cycle of growth regime transitions with two dominant poles: the entrepreneurial and the downsizing growth regimes. Growth regimes may change over time and space but they nevertheless seem to follow typical patterns. A high level of start-up activity may be able to stimulate the economic development of a region and at some

point provide enough new jobs to substitute for the losses from incumbent and exiting firms. The driving force of regional growth is a high level of start-up activity, being the seedbed of future employment and economic growth. In the long run, each district is apt to follow a growth regime life cycle and may be expected to undergo the typical pattern of growth regime transition. A high level of start-up activity may lead to intensified competition, to an acceleration of structural change, and to amplified innovation, and may also allow for a greater variety of products, thus leading to economic growth (Fritsch and Mueller, 2004).

## **6. Final discussion**

Re-estimating the empirical work in a paper on regional growth regimes by Audretsch and Fritsch (2002) with data from a longer time series, shorter sub-periods of analysis, and for smaller spatial units has provided a number of new insights. We can confirm the result attained by Audretsch and Fritsch (2002), that the strength of the relationship between new firm formation and regional development is not invariant but differs over time. We can also confirm that the start-up history of the regions plays a role in regional development. Even start-ups that occurred more than ten years ago may be regarded as having an influence on current employment change. The regional start-up history becomes particularly obvious when analyzing the transition between the different types of regional growth regimes as introduced by Audretsch and Fritsch (2002). We found typical transitions between the different types of growth regimes that do suggest some kind of life-cycle approach to regional development with regard to new firm formation: namely from revolving-door to entrepreneurial to routinized to downsizing.

All of this shows that new firm formation and entrepreneurship play a significant role for regional development. This relationship may be quite complex, however, and there are considerable time lags before new firm formation leads to increased employment (see Fritsch and Mueller, 2004, for an analysis of the effects over time). There is also little doubt that new firms are a seed for future growth. One of the important policy questions is what could be done to provide an environment that is conducive for these seeds to flourish.

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## Appendix

*Table A1: Correlation Matrix of average sector-adjusted start-up rates*

	Average sector-adjusted start-up rates			
	1983/84	1988/89	1993/94	1998/99
1983/84	1.0000	-	-	-
1988/89	0.9368	1.0000	-	-
1993/94	0.9196	0.9291	1.0000	-
1998/99	0.8789	0.8924	0.9457	1.0000

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