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Entrepreneurship, growth, regional growth regimes

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by

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Entrepreneurship, Growth, Regional Growth Regimes*

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January 2015

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Abstract

We distinguish four types of regional growth regimes based on the type of relationship between new business formation and economic development. The distinguishing characteristics of these regime types are analyzed in order to identify the reasons for different growth performance. Although growth regimes are highly persistent over time, typical transition patterns between regime types can be identified. We explain these patterns and draw conclusions for policy. The evidence clearly suggests that entrepreneurship is a key driver of economic development, and one that has long-run effects.

Keywords: Entrepreneurship, new business formation, economic development, regional growth regimes

JEL classification: L26, R11, O11

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1. Different patterns of entrepreneurship and growth

The notion of regional growth regimes¹ is based on the idea that the drivers of economic development may vary considerably across regions. We speak of “growth regimes” in recognition that such differences in economic development may result from a complex interplay of a variety of factors. In investigating the role entrepreneurship plays in growth, we apply a typology based on the type of relationship between new business formation and economic development, which was introduced by Audretsch and Fritsch (2002) and further analyzed by Fritsch and Mueller (2006). A particular advantage of our study, compared to previous analyses, is that we have a more comprehensive dataset that covers a considerably longer period of time. We investigate the distinguishing characteristics of the four kinds of growth regime and analyze transitions between these regimes over time. The results help better understand the forces behind different regional growth trajectories and clearly show that the effects of new business formation on regional development can be very long lasting.

The remainder of the paper is organized as follows. First, we introduce the general concept of regional growth regimes and make a distinction between four types of them that is based on the effect of new business formation on regional growth (Section 2). Section 3 elaborates on these four regime types and develops hypotheses about their characteristics. Section 4 describes the database and shows the distribution of growth regime types across time and space. We then analyze regime characteristics (Section 5) and transition patterns between regime types over time (Section 6). In Section 7, we provide an interpretation of the development patterns of growth regime types and discuss critical points in the development of the growth regime life cycle. The final section (Section 8) concludes.

¹Audretsch and Fritsch (2002), Fritsch (2004), Fritsch and Mueller (2006).

2. Regional growth regimes

2.1 What is a regional growth regime?

We define a regional growth regime as a set of economic and institutional conditions that influence the level of regional entrepreneurship and regional growth. Focusing on the effect of new business formation on regional growth, our typology of regional growth regimes is based on two assumptions for which there is compelling empirical evidence. The first assumption is that the regional context has a significant effect on the level and type of new business formation (for an overview, see Sternberg 2011). The second assumption is that the regional context plays a significant role in the effects that new businesses have on the process of regional development (see Fritsch 2013). Given the role of the economic and institutional context for entrepreneurship, it can be regarded as a “systemic” phenomenon; indeed, one could even speak of a “regional system of entrepreneurship” (Qian, Acs and Stough 2013) that also constitutes an important part of the regional innovation system (Cooke 2004). The relevant institutional context comprises the formal “rules of the game” (North 1994), such as tax laws and labor legislation, as well as the informal institutions of norms, values, and codes of conduct (Baumol 1990; North 1994), both types of institutes together constituting the regional entrepreneurship “culture.”² A positive culture of entrepreneurship is marked by a high level of social acceptance and approval of self-employment (Kibler, Kautonen and Fink 2014) that result in high levels of new business formation. Recent research indicates that such a culture is also conducive to a positive effect of new business formation on economic development (Glaeser, Kerr and Kerr 2014; Fritsch and Wyrwich 2014b).

Being part of the regional innovation system, growth regimes are characterized by a certain knowledge stock. Although new firms may generate important knowledge about the (non-)viability of business

² An entrepreneurial culture is typically defined as a “positive collective programming of the mind” (Beugelsdijk 2007, 190) or an “aggregate psychological trait” (Freytag and Thurik 2007, 123) of the population oriented toward entrepreneurial values such as individualism, independence, and achievement (e.g., McClelland 1961; Hofstede and McCrae 2008).

concepts, the focus of growth regimes is on knowledge exploitation via start-ups. Hence, the notion of regional growth regimes applies the “knowledge spillover theory of entrepreneurship” in a regional context (Acs, Audretsch and Lehmann 2013), but also includes those new businesses that are not knowledge-intensive. To the degree new business formation is determined by the regional knowledge stock, the extent and nature of this knowledge and, particularly, the ability of regional actors to absorb external knowledge and produce new knowledge should determine the number and characteristics of start-ups. There is some overlap between the idea of regional growth regimes and the common concept of technological regimes, which emphasizes the role of certain characteristics of a knowledge base for new business formation (Winter 1984; Audretsch 1995, 47–55; Marsili 2002).

The concept of regional growth regimes suggests that the sources and mechanisms of growth may vary considerably across regions, meaning that regions can be regarded as having different production functions. Accordingly, factors such as new firm formation, large firm presence, innovation, qualification, labor mobility, and the like may not play the same role in all regions. The existence of different growth regimes means that different theories may be required to explain their development and also has important implications for policy aimed at stimulating growth. If the way economic growth occurs differs between regions, then distinct policy strategies may be not only appropriate, but necessary for spurring regional development.

2.2 Entrepreneurship and development: Four types of regional growth regimes

Audretsch and Fritsch (2002) suggest a distinction between four types of regional growth regimes that should account for differences with regard to the role that new firms and entrepreneurship play in development.

Analogous to a technological regime, a region’s growth regime is called *entrepreneurial* if relatively high growth corresponds with a high level of new firm start-ups and a turbulent enterprise structure. It is assumed that in these regions, growth results from new business formation. In contrast,

above-average growth in regions with low start-up rates is probably due to relatively stable, large incumbent enterprises. Audretsch and Fritsch (2002) characterize this combination of new business formation and growth as a *routinized* growth regime (Figure 1). In the routinized regime, new businesses do not play an important role, and their chances for survival and growth are probably much lower than in an entrepreneurial regime.

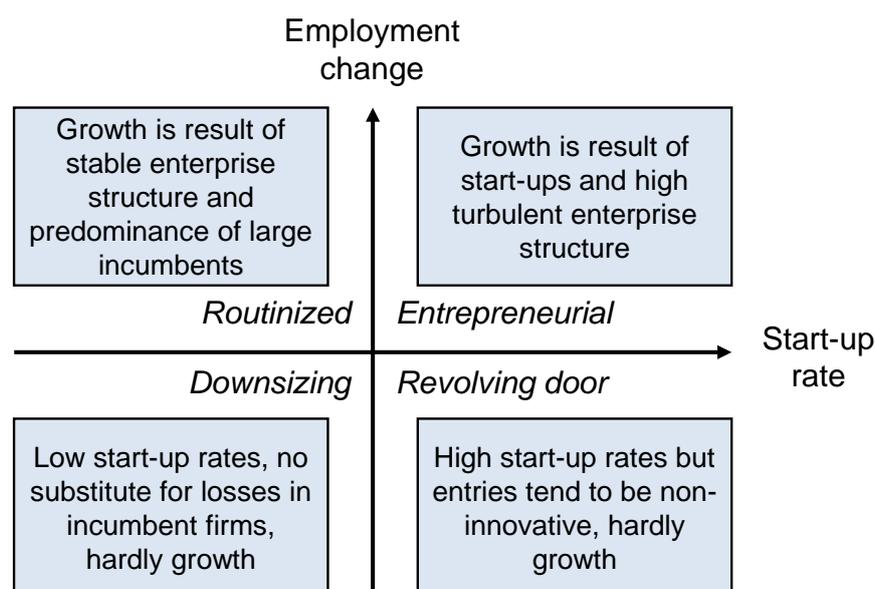


Figure 1: Regional growth regime types and their characteristics

Audretsch and Fritsch (2002) characterize regions with relatively low growth rates but above-average start-up rates as *revolving-door* growth regimes. They conjecture that in such a regime, entries will tend to be non-innovative, supplying basically the same products and using nearly the same technology as the incumbent firms. Finally, relatively low-growth regions characterized by a below-average level of start-up activity are classified as *downsizing* growth regimes. In such regions, the number and quality of start-ups is insufficient to provide enough new jobs or income to compensate for the losses in incumbent firms.³

³ Audretsch et al. (2012) in an analysis of the relationship between regional conditions and the propensity to start a business use the term „entrepreneurial regime” to characterize regions where the members of the labor force have a relatively high

Fritsch and Mueller (2006) analyze transitions between these types of growth regimes and identify patterns that suggest a type of “lifecycle” for regional development. These transition patterns are analyzed in detail in Section 6.

3. Characteristics of the four growth regime types: Hypotheses

There are a number of reasons for expecting that the four growth regimes described above will have distinct characteristics. This section deals with three broad categories of such reasons: the regional knowledge base and the quality of start-ups (Section 3.1), the regional industry structure (Section 3.2), and a region’s general entrepreneurial environment (Section 3.3). We derive hypotheses about each category’s relationship with regional development. Section 3.4 then summarizes.

3.1 The regional knowledge base and the quality of start-ups

Regional knowledge bases are diverse, comprised, to various degrees, of public and private research and development (R&D), the presence and the activity of higher education institutions, and the qualification of the regional workforce. According to the knowledge-spillover theory of entrepreneurship (Acs, Audretsch and Lehmann 2013), the size and quality of the regional knowledge base can have a positive effect on the number of start-ups, particularly on the emergence of those start-ups that exert significant competitive pressure on incumbent firms. Such challenging start-ups can be expected to contribute more to regional growth (Fritsch 2013) than purely imitative new businesses that are never more than marginal, undersized, poor-performance enterprises (also called “Muppets”) (Nightingale and Coad 2014). A positive effect of the regional knowledge base, however, is in no way limited to new businesses but can also be a main source of success for incumbent firms. We thus expect to find a larger knowledge base in regions with above-average growth, that is, in those regions classified as being host to either an

propensity for starting an own business. Regions with lower propensities to start a business are characterized as having a “routinized regime”.

entrepreneurial or routinized regime as compared to regions with a revolving-door or a downsizing regime.

Although both entrepreneurial and routinized regions may have relatively large knowledge bases, the character of this knowledge can vary according to the technological regime present in them (Winter 1984; Audretsch 1995; Marsili 2002). Hence, in regions with an entrepreneurial growth regime, a high share of the relevant knowledge is expected to be related to an early stage of a product lifecycle, whereas in a routinized growth regime, activity and knowledge related to a later stage of the lifecycle is expected to prevail. We also expect a high share of knowledge in the later stage of the product lifecycle in a downsizing regime. We do not have a clear expectation in this regard for regions with a revolving-door regime. If anything, we may presume that a considerable part of knowledge in these regions is in the entrepreneurial phase of the product lifecycle because this would correspond to empirical analyses that show relatively low survival rates of start-ups entering the market at such an early stage (Audretsch 1995).

Using market survival as an indicator for the quality of a start-up, Fritsch and Noseleit (2013a) and Brixy (2014) show that new businesses that manage to survive for a certain period of time have a positive effect on regional development, whereas the effect of start-ups that exit soon after entry is insignificant. We thus expect higher survival rates for newly founded businesses in regions with an entrepreneurial growth regime compared to regions with a revolving-door regime. To the extent that new businesses contribute to employment growth in a routinized regime, we expect higher survival rates in regions with a routinized regime compared to regions with a downsizing regime.

3.2 Regional industry structure

The industry structure of incumbent firms in a region may be important for a number of reasons. First, it represents a large part of the regional knowledge base that may be exploited by start-ups. Since founders have a strong tendency to set up their venture in an industry in which they have

previously worked and have experience with (Fritsch and Falck 2007), the characteristics of the incumbents' knowledge base and the type of technological regime in which these operate will shape the industry structure of future start-ups. Another aspect of the regional industry structure that should have an effect on knowledge exploitation by start-ups is the minimum efficient size of regional industries. Accordingly, regions that have high shares of industries with low minimum efficient size should also experience relatively high levels of new business formation in these industries. Hence, it is expected that these regions will have a high employment share in smaller businesses that act as "seedbeds" for new business formation in the future.⁴

Fritsch and Noseleit (2013b) find that the effect of new business formation on growth is more pronounced in regions with a high share of small business employment. They suspect that this result is due to the fact that young businesses start small and are more likely to compete with other small businesses than with large firms and that this more intense competition between new businesses and incumbents leads to a relatively strong effect on regional growth. We therefore suspect that there will be a higher share of small firm employment in regions with an entrepreneurial regime compared to regions with a revolving-door regime.

Another factor that may have an effect on regional performance is the concentration or variety of the industry structure, although empirical support for this idea is ambiguous. Frenken, van Oort and Verburg (2007) and Boschma and Frenken (2011) argue that it is not industry variety per se, but the related variety of similar or complementary industries, that has positive effects. And, indeed, there is evidence that new businesses formation can make an important contribution to the emergence of such related variety (Neffke, Henning and Boschma 2011). Noseleit (2013) compares the industry structure of entries with the industry structure of incumbents, as well as with the industry structure of those firms that exit.

⁴ The relatively high propensity of smallfirm employees to start an own firm is well documented by empirical research (Parker 2009; Elfenbein, Hamilton and Zenger 2010). Another reason small average firm size in a region may lead to a high number of start-ups is that it implies a high density of entrepreneurs who act as role models for potential founders (see Bosma et al. 2012).

He finds that dissimilarity of these structures has a pronounced positive effect on regional development in West German regions. Based on these results, we expect that dissimilarity of industry structure between start-ups and exits will be particularly high in regions with an entrepreneurial growth regime and relatively low in regions that are characterized by a revolving-door regime.

The share of regional employees in knowledge-intensive business services (KIBS) may indicate at least two things. First, it can demonstrate a well-developed and relatively rich knowledge base in a region, particularly a high level of labor division in knowledge-intensive activity. Second, it is an indicator for the availability of knowledge that may be conducive to the competitiveness and development of the local economy. Since local availability of knowledge inputs can be particularly important for the success of start-ups suffering from unbalanced skill sets (Helsley and Strange 2011), we expect a positive relationship between the employment share in KIBS and the success of start-ups. Hence, high shares of KIBS employment should be found particularly in regions with an entrepreneurial growth regime. High shares of KIBS employment may also be found in routinized regimes where large firms have a long-established division of labor with local service suppliers. Specifically, we expect a higher share of KIBS employment in regions with a routinized regime compared with regions characterized by a downsizing regime.⁵

3.3 General regional entrepreneurial environment

It is not far-fetched to expect that regions with relatively high start-up rates might have favorable conditions for entrepreneurship. These can include easy accessibility of inputs such as labor and finance, as well as a generally held positive attitude toward self-employment (Kibler, Kautonen and Fink 2014; Westlund, Larsson and Olsson 2014) and a large number

⁵ Since KIBS tend to rely heavily on geographic proximity to customers they tend to be located in larger cities, delivering their services across considerable spatial distance. Hence, the regional share of KIBS employment could be primarily determined by the regional level of urbanization while their effect may not be limited to the region where they are located. In this case, the effect of the local share of KIBS employment on the success of new businesses in that particular region may be found to be not statistically significant (Keeble and Nachum 2002; Wood 2005).

of entrepreneurial role models (Bosma et al. 2012). Thus we expect especially high shares of self-employed persons in regions with an entrepreneurial regime and a revolving-door regime as compared to the two other regime types.

Since several empirical studies show that high levels of entrepreneurship tend to be persistent over time (Andersson and Koster 2011; Fotopoulos 2014; Fritsch and Wyrwich 2014a), it is expected that most of the transitions between types of growth regime will be between those with a relatively high start-up rate (entrepreneurial, revolving door) and those with a relatively low start-up rate (routinized, downsizing). We thus expect relatively high levels of transition, especially between revolving-door and entrepreneurial regimes as well as between routinized and downsizing regimes.

3.4 Summarizing the hypotheses

Table 1 provides a summary of the general characteristics we expect to find in the different types of growth regimes. In Table 2, we summarize our expectations regarding the regional characteristics of certain regime types. These expectations are reported in pairwise comparison in line with our empirical approach. With regard to the effect of new business formation on regional growth the most interesting comparisons are between the entrepreneurial and the revolving door regime as well as between the routinized and the downsizing regime. These are the cases where a relatively high or low level of start-up activity leads to above or below average employment growth. Hence, these comparisons should reveal some of the reasons for the opposite development patterns. The most pronounced differences should be found between the two extreme cases with regard to new business formation and growth, i.e., the entrepreneurial regime and the downsizing regime. According to Table 2 a relatively small number of differences is to be expected between the revolving door regime and the downsizing regime.

Table 1: Summary of the general regional characteristics

Regional characteristic	<i>Entrepreneurial regime</i>	<i>Revolving-door regime</i>	<i>Routinized regime</i>	<i>Downsizing regime</i>
<i>Regional knowledge base and quality of start-ups</i>	High knowledge intensity and high level of innovation; high share of activity under the conditions of an entrepreneurial technological regime	Low knowledge intensity and low level of innovation; low quality and low survival rates of start-ups	High knowledge intensity and high level of innovative output; high share of activity under the conditions of a routinized technological regime	Low knowledge intensity and low level of innovative output; low survival rates of start-ups; high share of activity under the conditions of a routinized technological regime
<i>Regional industry structure</i>	High share of small firms; high variety of industry structure; high employment share in knowledge-intensive services; entries strongly induce variety of industry structure	Relatively high share of small firms; low level of structural change (industry structure of entries similar to structure of exits); low variety of industry structure	Low share of small firms; low variety of industry structure but high employment share in knowledge-intensive services	High share of large firms; low variety of industry structure; low level of structural change (industry structure of start-ups similar to industry structure of exits)
<i>General regional entrepreneurial environment</i>	Favorable conditions for entrepreneurship, such as high level of peer effects and easy access to supportive infrastructure and other important resources	Low level of supportive infrastructure, but high level of peer effects	Low level of both supportive infrastructure for start-ups and peer effects	Low level of both supportive infrastructure for start-ups and peer effects

Table 2: Expected differences between growth regime types

<i>Regional characteristics</i>	<i>Indicator</i>	<i>Entrepreneurial vs. revolving door</i>	<i>Entrepreneurial vs. routinized</i>	<i>Entrepreneurial vs. downsizing</i>	<i>Revolving door vs. routinized</i>	<i>Revolving door vs. downsizing</i>	<i>Routinized vs. downsizing</i>
<i>Regional knowledge base and quality of start-ups</i>	Share of highly qualified workforce	+	≈	+	-	≈	+
	Share of private-sector R&D employment	+	≈	+	-	-	+
	Survival rates of new businesses	+	+	+	-	≈	+
<i>Regional industry structure</i>	Employment share of small businesses	+	+	+	+	+	≈
	Similarity of industry structure between entries and exits	-	-	-	≈	≈	≈
	Level of industry diversity	+	+	+	≈	≈	≈
	Share of KIBS employment	+	≈	+	-	≈	+
<i>General entrepreneurial conditions</i>	Self-employment rate	≈	+	+	+	+	≈

Notes: “+” denotes “higher” and “-” denotes “lower” values for the first indicated growth regime; “≈” means that we do not expect any significant differences between the two regime types.

4. Data issues

4.1 Data sources and classification into regime types

The spatial framework of our analysis is comprised of the 71 planning regions of West Germany,⁶ which represent functionally integrated spatial

⁶ We restrict our analysis to West Germany because many empirical studies indicate that the East German economy in the 1990s was a special case with very specific conditions that cannot be directly compared to those of West Germany (cf. Fritsch 2004). There are actually 74 West German planning regions. For administrative reasons, the cities of Hamburg and Bremen are defined as planning regions even though they are not functional economic units. To avoid distortions, we merged these cities with adjacent planning regions. Hamburg was merged with the region of Schleswig-Holstein South and Hamburg-Umland-South. Bremen was merged with Bremen-Umland. Thus, the number of regions in our sample is 71.

units comparable to labor market areas in the United States. Our data on new business formation are obtained from the German Social Insurance Statistics. This dataset contains every establishment in Germany that employs at least one person obliged to make social insurance contributions (Spengler 2008). The start-up rate is the yearly number of new businesses in the private sector divided by the number of those employed in the private sector labor force (in 1,000s).⁷ In contrast to previous studies (Audretsch and Fritsch 2002; Fritsch and Mueller 2006), we exploit a novel and more reliable method of identifying start-ups in the data that is based on workflow analyses (Hethey and Schmieder 2010). Another main advantage of our work over previous studies is our considerably longer time period of more than 30 years, from 1976 to 2011. Data on establishment size distribution, qualification of workforce, R&D employment, and sectoral structure are also obtained from the Social Insurance Statistics; other information is from the Statistical Offices and other sources. All industry related measures account for changes in the industry classification over time (for details see Eberle et al. 2011).

Classification into the four types of growth regime is based on the average start-up rate for the first two years of the respective time period and the percentage employment change for the whole period. Because the main part of the positive employment effects of new businesses occurs only in the longer run (Fritsch 2013), it is important to relate the indicators for entrepreneurship to growth performance over a sufficiently long period. Fritsch and Mueller (2004) find, for West German regions, that the strongest positive effect of new business formation on regional employment occurs about seven to eight years after the new entities are set up. To capture such long-term effects we divide the period of analysis into four relatively long periods of eight years each: 1976–1984, 1985–

⁷ Start-ups in agriculture are not considered in the analysis.

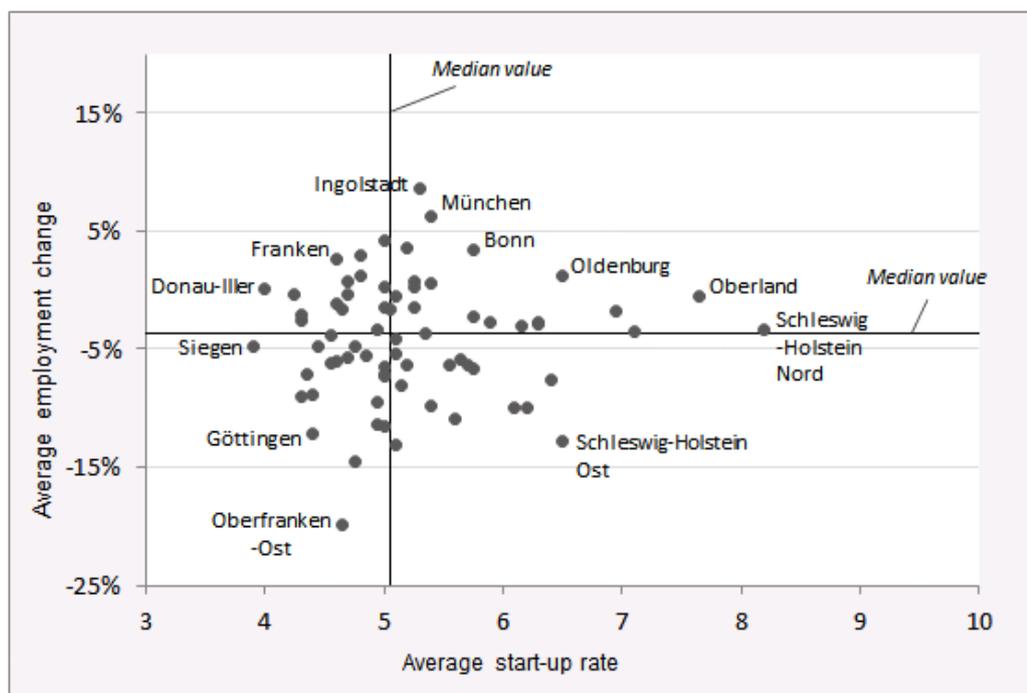


Figure 2: The relationship between new business formation and regional employment change in West German regions, 1994–2002

1993, 1994–2002, and 2003–2011. Figure 2 shows the distribution of regional growth regimes for the period 1994–2002 as an example.

The distinction into the four long time periods is particularly used for descriptive purposes (see Section 4.2) and for the empirical analyses of the development of growth regime types over time (Section 6). For the empirical analysis of the distinctive characteristics of the different growth regime types in Section 5 we define seven partly overlapping time periods (1979-1987, 1983-1991, 1987-1995, 1991-1999, 1995-2003, 1999-2007, 2003-2011) in order to increase the available number of observations. Moreover, this classification does not include the years 1975-1978 for which information about some of the regional characteristics is missing.

4.2 The spatial distribution of growth regime types

The geographical distribution of the four growth regime types in the different time periods (Figure 3) reveals two remarkable phenomena. First, we find no evidence of an erratic patchwork-like pattern of regional growth

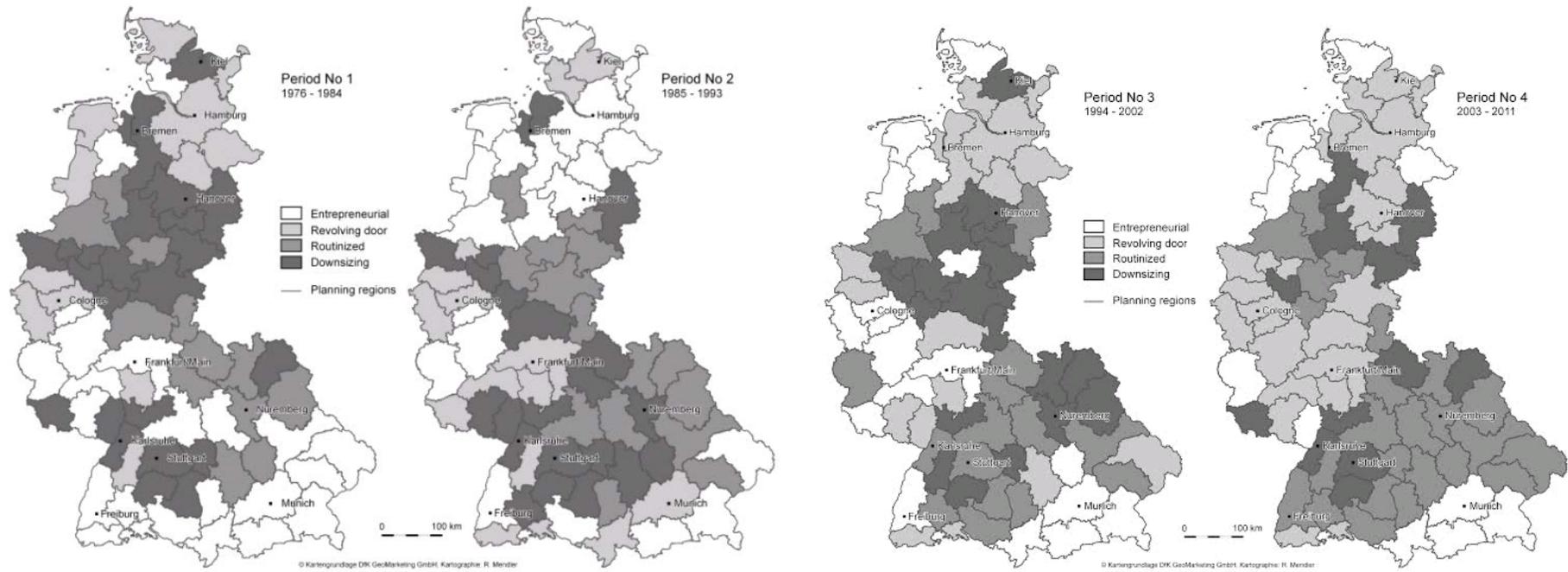


Figure 3: Regional distribution of growth regime types over time

regimes, but there are pronounced neighborhood effects in the sense that adjacent regions are frequently assigned to the same type of growth regime. Obviously, the regional context that has an effect on the relationship between entrepreneurial activity and economic development often encompasses more than a single planning region. Second, there is a pronounced tendency of regions to be assigned to the same type of growth regime in subsequent time periods, indicating a certain degree of persistence. As expected, transitions between regime types are mostly between those with relatively high (entrepreneurial and revolving door) and relatively low start-up rates (downsizing and routinized), indicating that the regional level of new business formation fluctuates less than regional employment growth.

An example of persistence of regional growth regime type is the southern part of Bavaria, particularly the Munich region and the regions south of it, which are in most or all observation periods classified as entrepreneurial. Also, a number of regions south of Hamburg and south of Frankfurt are always classified as entrepreneurial or revolving door. A downsizing or routinized regime is characteristic of the Ruhr area and of Stuttgart and surrounding regions.

5. Empirical analysis of regional growth regime characteristics

5.1 Variables

Our dependent variable represents the growth regime type as described in Section 4.1. The following explanatory variables are included in the analysis (see also descriptive statistics in Table A1-A5 in the Appendix).

- To measure the *regional knowledge base* we employ two variables. First, the *qualification level of the workforce* is captured by the share of private-sector employees with a tertiary degree in total private-sector employment. The second variable is the share of private-sector R&D as

measured by the share of R&D employees in private-sector employment.⁸

- Our proxy for *start-up performance and quality of entrants* is captured by start-up survival rates, namely, the share of private-sector start-ups still in existence after five years compared to the total number of start-ups in the respective year of foundation.
- *Establishment size* is measured by the share of private-sector employment in establishments with less than 20 employees over total private-sector employment. To reduce the statistical relationship with the start-up indicator—the majority of new businesses start out very small—we exclude the employment in the start-ups that emerged in the respective year.
- We construct several variables to account for *regional industry structure and its development*. The first employs an entropy measure of regional industrial diversity according to Theil (1972) and as used by Fotopoulos (2014). The measure can be constructed in a way that the values vary between 0 and 1, with 0 indicating the presence of only one industry in the region and 1 representing a situation where all industries employ an equal number of employees. The variety measure is based on a distinction of 28 industries. We also distinguish between related and unrelated variety based on entropy measures, as done by Frenken, van Oort and Verburg (2007). Unrelated variety of a region is calculated by the entropy at the two-digit level; related variety is calculated by the weighted sum of entropy at the three-digit level within each two-digit class.
- We use a measure of the similarity between industry affiliation of start-ups and exits employed by Noseleit (2013). Since the number of employees in start-ups might not be an appropriate indicator of their economic significance, we relate the mere number of start-ups to the number of exits. The similarity measure is calculated as a correlation

⁸ Another important aspect of the regional knowledge base is the presence and size of higher education institutions such as universities. Unfortunately, detailed information on higher education institutions is not available for the full period of analysis.

coefficient between the number of entries and the number of exits in 28 industries (two-digit level). This correlation coefficient can assume values from -1 to +1. A high level of correlation indicates a weak influence of entries on changes in the regional sectoral structure.

- The regional *supply of knowledge-intensive services* is measured by the share of employment in KIBS in total private-sector employment.
- As an indicator of the *general entrepreneurial conditions* in a region we use the self-employment rate, which is calculated as the number of establishments in a region's nonagricultural private-sector industries divided by the regional workforce, thus reflecting the number of entrepreneurial role models in a region.
- In addition to our set of explanatory variables, we also employ a number of *control variables*. Population density is used as a catch-all variable for various regional characteristics (e.g., congestion issues, housing and land prices, infrastructure availability, etc.). To capture effects of different political conditions, we include dummies for the Federal State to which a region belongs. Year dummies are included to control for time-specific effects.

5.2 Characteristics of regional growth regimes: t-tests of equal means

In the first step of the statistical analysis, we calculate the mean values for the regional characteristics in the different regime types over the complete observation period and conduct t-tests for significant differences between a particular growth regime type and the rest of the sample (Table 3). We find significant differences for all the variables considered.

The results show that regions with an entrepreneurial regime are characterized by a relatively high level of both self-employment and employment in small establishments. They have a relatively high level of industry diversity and relatively low similarity between the industry affiliation of entries and that of exits. Although the share of highly qualified

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

<i>Indicator</i>	<i>Full sample</i>	<i>Entrepreneurial</i>	<i>Revolving door</i>	<i>Routinized</i>	<i>Downsizing</i>
Share of highly qualified workforce	0.056	0.054	0.061***	0.053	0.053
Share of private sector R&D employment	0.024	0.023*	0.026**	0.024	0.025
Survival rates of new businesses	0.573	0.578*	0.552**	0.589	0.571
Employment share of small businesses	0.294	0.323***	0.314***	0.279***	0.264***
Self-employment rate	0.096	0.104***	0.102***	0.093***	0.085***
Similarity of industry structure between entries and exits	0.967	0.964*	0.974***	0.963***	0.967
Level of industry diversity	0.852	0.853	0.844***	0.861***	0.848**
Related variety	1.497	1.482*	1.514*	1.496	1.496
Unrelated variety	4.384	4.394	4.373	4.410***	4.356**
Share of KIBS employment	0.048	0.044	0.061***	0.048	0.039**
Population density (log)	5.405	5.253***	5.572***	5.201***	5.592***
Number of observations	497	108	131	137	121

Notes: Asterisks for each regime indicate that the mean of the particular regime is statistically different from the mean of all the rest of the sample. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

workforce in regions with an entrepreneurial regime is somewhat below average, new businesses in these regions have higher than average survival rates. Regions with a revolving-door regime have an above-average share of highly qualified workforce, but the survival rates of start-ups are relatively low. As in regions with an entrepreneurial regime, the share of employees in small establishments is relatively high in revolving-door regimes. Regions with a revolving-door regime exhibit the lowest level of industry diversity while the similarity between the industry structure of exits and entries is the highest. Surprisingly, regions with a revolving-door regime are characterized by a relatively high share of employment in KIBS.

The characteristics of regions with a routinized regime are rather similar to regions with a downsizing regime. Both types of regions have a below-average share of highly qualified workforce, and below-average self-employment rates. The relatively small share of employment in small businesses indicates an on average large establishment size. In regions with a routinized regime type, the similarity between the industry structure of entries and that of exits is relatively low. Below-average similarity of industry structure between entries and exits indicates a relatively high level of structural change in regions with a routinized regime. In regions with a downsizing regime, this type of similarity is about average. Another difference between the two types of regions is that the share of KIBS employment is about average in regions with a routinized regime and significantly below average in regions with a downsizing regime. Furthermore, the population density of downsizing regions is above average, whereas it is below average for regions with a routinized regime. High population density is also a characteristic of regions with a revolving-door regime. In regions with an entrepreneurial regime, population density is significantly below average.

These differences of means tests provide a first impression of the characteristics of regions with different growth regime types, but the impression may be hazy and imprecise for at least two reasons. First, since we always compare the regions of a certain growth regime type with all remaining regions, the sample used for the comparison—all other regions—is not the same across regime types, which makes interpretation difficult. Second, since the variables are related to each other, multivariate analysis should be performed. We thus pairwise compare the characteristics of the different growth regime types by multivariate analyses (for t-tests for equal means of such a pairwise comparison, see Table A9 in the Appendix).

5.3 Multivariate analyses of regime type characteristics

5.3.1 Methodology

To test the hypotheses developed in the Section 3, we use probit regression analysis to estimate the effect of the distinctive set of regional characteristics on the likelihood that the region will belong to the particular regional growth regime. Our dependent variable assumes the value 1 if a region belongs to certain growth regime and 0 otherwise. The base model is specified as follows:

$$P(Y_{it} = 1|X_{it}) = \beta_0 + \beta_1 HC_{it} + \beta_2 SURV_{it} + \beta_3 RD_{it} + \beta_4 SMALLF_{it} + \beta_5 SIM_{it} \\ + \beta_6 DIV_{it} + \beta_7 KIBS_{it} + \beta_n x_{it} + \varepsilon_{it}$$

with

Y_{it} – an indicator for the particular growth regime type of region i in time period t ;

HC_{it} – the share of employees with a tertiary degree;

$SURV_{it}$ – the five-year survival rate;

RD_{it} – the share of R&D employees in private-sector employment;

$SMALLF_{it}$ – the share of employment in establishments with less than 20 employees excluding employment in start-ups of the current year (in alternative specifications, we use the self-employment rate — SER_{it} — instead);

SIM_{it} – the level of similarity between the industry structure of the start-ups and that of the exits;

DIV_{it} – the regional diversity index (for alternative model specifications we include the related variety index — $RELV_{it}$ — and the unrelated variety index — $UNRELV_{it}$ — instead);

$KIBS_{it}$ – the share of employment in KIBS;

X_{it} – a set of control variables (population density, Federal State dummies, year dummies);

ε_{it} – the error term.

We make pairwise comparisons of the growth regime types, resulting in six models. As a robustness check we also create a model in which we position each regime type against all other types (see Table A10 in the Appendix). Due to the high correlation between some of the variables of interest, we do not include all these variables in the base model but test the effect of the other variables in separate models. The dependent variable assumes the value 1 for a particular type of growth regime and is 0 for the comparison group. The independent variables relate to the first year of the respective period. We run the regressions with random effects in order to account for time-invariant factors such as affiliation with a certain Federal State. This is particularly appropriate because a number of variables show very little change over time so that in a fixed effects setting, their influence would mainly be assigned to the fixed effects.

5.3.2 Pairwise comparison of characteristics of regional growth regimes

Table 4 shows the results of the pairwise comparisons of the different regime types. The results of the analyses support our general hypothesis that the sources and mechanisms driving regional development might vary considerably across types of regional growth regime. We find that regions with an entrepreneurial growth regime have a higher share of highly qualified workforce than regions with a revolving-door and a routinized regime. This finding clearly emphasizes the importance of the regional knowledge base for the number and quality of start-ups. Surprisingly however, there is no significant difference in this regard between regions with an entrepreneurial regime and a downsizing regime. According to our expectations, regions with either an entrepreneurial or a revolving-door regime have significantly higher shares of small business employment than regions with a routinized or downsizing regime. This higher share of employment in small businesses may be the source of a relatively high

Table 4: Distinctive characteristics of regional growth regimes (marginal effects)

<i>Indicator</i>	<i>Entrepre- neurial vs. revolving door</i>	<i>Entrepre- neurial vs. routinized</i>	<i>Entrepre- neurial vs. downsizing</i>	<i>Revolving door vs. routinized</i>	<i>Revolving door vs. downsizing</i>	<i>Routinized vs. downsizing</i>
Share of highly qualified workforce	6.79** (2.79)	6.25** (3.17)	0.83 (2.35)	-5.30*** (1.99)	6.67** (3.39)	15.65*** (4.51)
Survival rates of new businesses	5.53*** (1.43)	-0.15 (1.03)	2.67*** (0.90)	-1.31 (1.17)	-2.77** (1.07)	3.24** (1.37)
Employment share of small businesses	2.54** (1.17)	8.05*** (1.07)	8.23*** (1.06)	6.55*** (1.00)	9.54*** (1.89)	3.70* (1.92)
Similarity of industry structure between entries and exits	-3.67* (2.09)	-1.52 (1.33)	0.06 (1.19)	4.19* (2.23)	0.46 (1.39)	0.52 (2.00)
Level of industry diversity	3.59* (2.16)	-1.67 (1.77)	3.53* (1.81)	-5.39** (2.08)	0.96 (2.38)	4.10** (2.04)
Share of KIBS employment	-1.9 (2.48)	-2.42 (2.93)	-0.16 (0.66)	-0.17 (0.60)	0.7 (2.37)	-9.26** (3.77)
Population density (log)	0.06 (0.12)	0.38*** (0.12)	0.16 (0.11)	0.53*** (0.12)	0.31** (0.15)	-0.31** (0.15)
Year dummies	Yes	Yes*	Yes	Yes	Yes*	Yes*
Federal State dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	239	245	229	268	252	258
Log likelihood	-130.28	-69.93	-72.01	-69.28	-71.54	-124.24
Chi2	41.78	16.28	31.8	24.1	16.54	29.04

Notes: Dependent variable: First mentioned regime (= 1) versus second mentioned regime (= 0). Random effects probit regression, standard errors in parentheses. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

number of start-ups, reflecting the relatively high propensity of small firm employees to start an own firm (Parker 2009), as well as a result of high levels of new business formation because most start-ups remain small.

The most interesting pairwise comparisons with regard to employment generation are between high and low start-up regions with above and below average employment growth, that is, entrepreneurial versus revolving door regimes and routinized versus downsizing regimes. In this comparison we find several significant differences. Regions with an entrepreneurial regime have a higher share of qualified workforce and higher rates of new business survival, which probably contribute to a higher share of small business employment. Moreover, regions with an entrepreneurial regime have a lower level of similarity between entries and

exits and higher degrees of industry variety, particularly related variety (see Table A13 in the Appendix).

Comparing the characteristics of a routinized regime with those of a downsizing regime we find that the former are characterized by a significantly larger share of highly qualified employees, higher rates of new business survival, a higher share of small business employment, and a higher level of industry diversity. Moreover, regions with a routinized regime are characterized by a lower population density as well as by a lower employment share of KIBS. In the comparison of a revolving-door regime to a routinized regime, there is a higher share of highly qualified employees, a larger share of small business employment, a higher degree of similarity between entries and exits, a lower level of industry diversity and higher population density in regions with a revolving door regime. In models where we distinguish between related and unrelated variety of industry structure (Table A13 in the Appendix), we find a higher level of related variety in regions with a routinized regime (however, only when compared to revolving-door regime).

Comparing the two regime types with above-average employment growth—entrepreneurial and routinized—we find a significantly higher share of highly qualified workforce, a higher share of small business employment, and greater population density in regions with an entrepreneurial regime. Similar differences can be found between revolving door regimes and downsizing regimes. In addition downsizing regions have higher survival rates of new businesses than revolving-door regions.

A number of robustness checks were performed. Due to the high correlation between the share of highly qualified workforce and the share of private-sector R&D employment, we ran the models separately with just one of the two measures (for results with the share of private-sector R&D employment, see Table A11 in the Appendix). Likewise, different models were run with the small business employment share and the self-employment (for results with the self-employment rate see Table A12 in the Appendix). Separate models were also been run with the measure for

overall industry diversity and related and unrelated variety among the regional industries (Table A13 in the Appendix). Since the values of the start-up rate or employment change for some regions are close to the median values, we also ran models where we excluded those regions whose values of the start-up rate and employment change were within a 3 percentile distance on either side of the median values of the respective time period (Table A14 in the Appendix). This resulted in dropping around 16-20 percent of regions over all time periods. These robustness checks did not lead to any results significantly different from those obtained from the main model.

As another robustness check we have defined growth regimes based on sector-adjusted start-up rates that should control for the fact that the composition of industries not only varies across regions but that the relative importance of new and incumbent businesses also varies systematically across industries (for details, see the Appendix of Audretsch and Fritsch, 2002). Empirical results do not lead to significant contradictions compared to the base models, however, indicators for industry structure and its change reduced in significance, as was to be expected.

6. The development of growth regimes over time

6.1 Transition probabilities

The spatial distribution of growth regime types over time (Figure 3) shows, on the one hand, that regions demonstrate a tendency to remain in the same category for subsequent periods. On the other hand, there are quite considerable changes. To analyze these patterns, we first calculate transition probabilities for the different regime types. The results are shown in Figure 4 and in Table A8 in the Appendix.

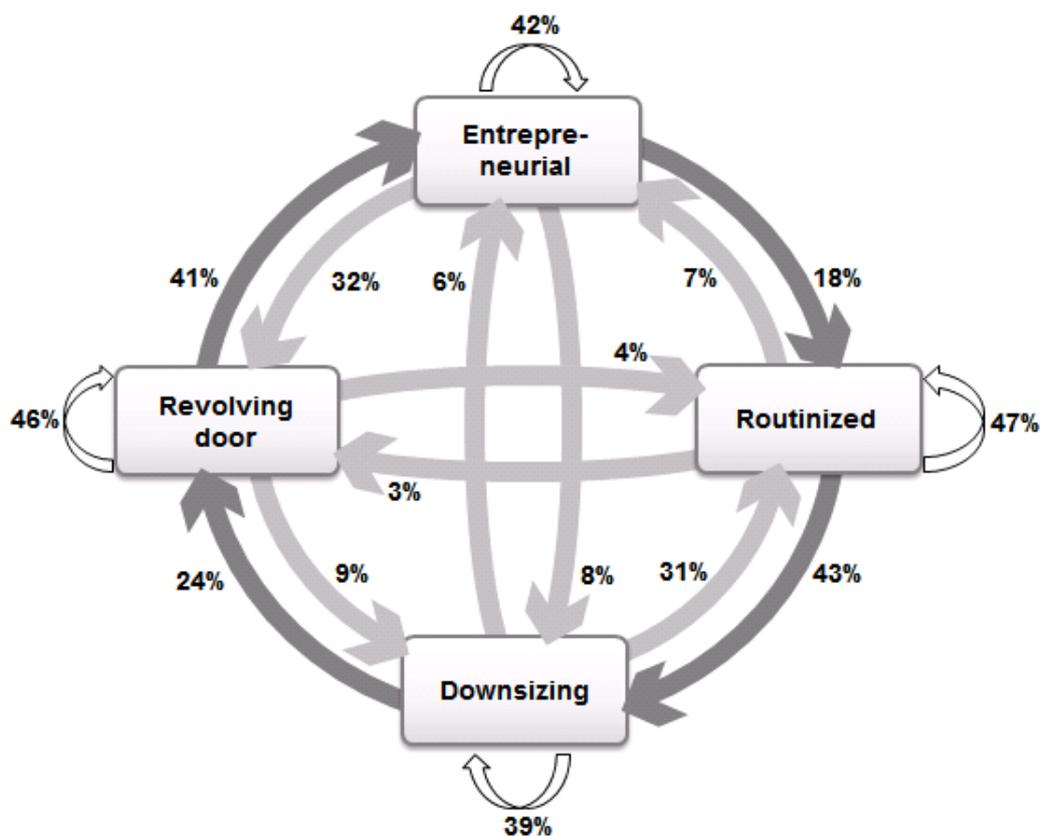


Figure 4: Transition probabilities of the regional growth regime types

Generally, the probabilities for the transition of regions between different regime types indicate a high level of persistence over time. On average, 42 percent of the entrepreneurial regions stay entrepreneurial in the following time period. The probability of remaining entrepreneurial is 31 percent higher than that of switching to revolving-door and 2.3 times higher than becoming routinized. Our analysis indicates a low probability for a direct transition from entrepreneurial regime to downsizing regime (8 percent). Revolving-door regions have a high probability of either remaining revolving-door (46 percent) or becoming entrepreneurial (41 percent) in the following time period when compared to the probability of switching to downsizing (9 percent) or routinized (4 percent). Routinized regions have a high probability of either remaining routinized (47 percent) or becoming downsizing (43 percent). The probability of switching to an entrepreneurial type of regime is relatively low (7 percent) for these regions. It is remarkable that there is only one instance of a region switching directly from having a routinized regime to having a revolving-

door regime in the period of analysis. Once being host to a downsizing regime, a region has the highest probability to remain downsizing (39 percent) and the lowest probability of experiencing a direct transition to an entrepreneurial regime (6 percent).

Transition probabilities tend to be higher between the entrepreneurial and the revolving-door types of regime and between routinized and downsizing regimes. Technically speaking, this pattern indicates that changes in the relative level of new business formation tend to be smaller than changes in the relative level of employment growth. Accordingly, the probability of an entrepreneurial regime to become a routinized regime is only 18 percent as compared to a probability of 32 percent for an entrepreneurial regime to become a revolving door type and a probability of 43 percent for a routinized regime to become downsizing (Figure 4).

Generally, our findings are in line with the analysis of Fritsch and Mueller (2006) and suggest a typical long-term development pattern. Accordingly, if a region with a downsizing regime experiences an increase in new business formation, it will most probably have a revolving-door regime before it eventually attains an entrepreneurial growth regime. Correspondingly, if a region with an entrepreneurial growth regime experiences a decline in the level of new business formation, it will first assume the character of a routinized growth regime before eventually becoming host to a downsizing regime.

These results suggest that at least in some regions, the effect of new business formation on growth occurs with a time lag that is considerably longer than the 10 years suggested by a number of empirical analyses (e.g., Fritsch and Mueller 2004). It may take a long time before the growth effects of an increased level of entrepreneurship become evident and even if the start-up rate begins to decrease, the growth benefits of higher start-up rates in a region are likely to continue for a number of years.

6.2 How persistent are regional growth regimes?

Since simple transition probabilities do not account for the panel structure of the data, in a final step we analyze the statistical significance of the transition probabilities between the different types of growth regimes over time. The simple transition probabilities suggest that the entrepreneurial, as well as the downsizing, growth regimes tend to be stable over time, whereas the revolving-door and the routinized regimes appear to be more temporary in character. Indeed, for the revolving-door and routinized regimes, the probabilities of transitioning to other regime types are nearly the same as the probability of remaining in the same category, whereas for the entrepreneurial and downsizing regimes, the probabilities of remaining in the same category for two subsequent time periods are more pronounced. Moreover, the results suggest a typical development pattern, in which a region with a downsizing regime evolves, via a revolving door regime, into an entrepreneurial regime that may, in time, transform into a routinized regime with a high probability of becoming a downsizing regime again.

We employ probit analysis to estimate the persistence and transitional nature of the different growth regime types over time. The dependent variable reflects the respective type of growth regime (1=yes, 0 otherwise) and the independent variables represent the regime type the region belonged to in the previous period. We estimate

$$P(Y_{it} = 1|X_{it}) = \beta_0 + \beta_1 ENTR_{i,t-1} + \beta_2 REVD_{i,t-1} + \beta_3 ROUT_{i,t-1} + \beta_4 DOWN_{i,t-1} + \beta_n X_{it} + \varepsilon_{it}$$

where

Y_{it} – is an indicator for the growth regime type of a region i in period t ;

$ENTR_{i,t-1}$, $REVD_{i,t-1}$, $ROUT_{i,t-1}$ and $DOWN_{i,t-1}$ indicate whether the region had an entrepreneurial, revolving-door, routinized, or downsizing growth regime in period $t-1$ (1=yes, 0 otherwise);

X_{it} – is a set of control variables (Federal State dummies; year dummies)

with ε_{it} representing the error term.

To avoid over-determination of the model we do not include all four variables for the growth regime type in the previous period. Four sequential periods (1976–1984, 1985–1993, 1994–2002, 2003–2011; see Figure 3) are considered, allowing us to observe three transition events for each region. We run the regressions with random effects, thereby controlling for time-invariant factors by including dummies for Federal States.

Table 5: Persistence and change of growth regimes over time

<i>Indicator</i>	<i>Entrepreneurial</i>	<i>Revolving door</i>	<i>Routinized</i>	<i>Downsizing</i>
Entrepreneurial (t-1)	1.28*** (0.40)	0.37 (0.29)	-0.71* (0.40)	0.09 (0.39)
Revolving door (t-1)	1.53*** (0.42)	0.29 (0.40)	-1.33** (0.52)	
Routinized (t-1)	0.12 (0.44)	-0.65 (2.03)	-0.23 (0.50)	1.27*** (0.37)
Downsizing (t-1)				0.99*** (0.34)
Year dummies	Yes*	Yes	Yes	Yes*
Federal State dummies	Yes	Yes	Yes	Yes
Constant	-2.22*** (0.64)	0.27 (0.55)	-0.75 (0.76)	-1.96*** (0.59)
Number of observations	213	213	213	213
Log likelihood	-87.66	-91.93	-94.56	-97.09
Chi2	34.24	20.67	19.86	34.93

Notes: Dependent variable: Regime vs. rest of the regimes; Random effects probit regression; Standard errors in parentheses; ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

The results of the probit regressions (Table 5) indicate that belonging to the entrepreneurial and the downsizing regime type in a certain period significantly increases the probability of belonging to the respective regime type in the following period. No persistence is found for the revolving-door and the routinized regime. Results indicate that being a revolving-door regime significantly decreases the probability of becoming a routinized regime in the next period. Likewise, being an entrepreneurial

regime significantly decreases the probability of becoming a routinized regime. The results also show that revolving-door and routinized regimes are especially transitional in nature. Being a region with a revolving-door regime significantly increases the probability of becoming an entrepreneurial regime type in the next period, and regions with a routinized regime have a significant probability of becoming downsizing regimes in the following period.

The multivariate analyses confirm the pattern found for the simple transition probabilities (Section 6.1) and suggest a certain long-term development pattern for growth regime types. It can be concluded that if a region with low levels of entrepreneurship and low growth (downsizing regime) experiences an increase in new business formation, it will most probably become a revolving-door regime for some time before it eventually becomes an entrepreneurial growth regime, in which new business formation leads to considerable employment growth. Correspondingly, if regions with an entrepreneurial growth regime experience a decline in start-ups, they will first, and for some time, assume the character of a routinized growth regime before they eventually devolve into a downsizing regime.

7. Critical points in the development of the growth regime lifecycle

The analysis of transitions between different growth regimes suggests that regions are subject to a type of lifecycle development. Taking a situation with no economic activity as a starting point, the emergence of new businesses constitutes first a revolving-door regime, which may, after some time, become an entrepreneurial regime, then a routinized regime with a certain probability of turning into a downsizing regime. In this lifecycle, the entrepreneurial and downsizing regimes tend to be relatively stable, while the revolving-door and routinized regimes are more transitional in character. There are several real-world illustrations of such a lifecycle development. For example, there are regions dominated by a certain industry, such as the automobile industry in Detroit (USA) or the coal and steel industries in the Ruhr area in Germany, that have followed

a full lifecycle from the emergence of the industry to its decline in a mature stage. However, there are also regions with a more diverse industrial structure that show this type of development.⁹

The lifecycle pattern of development reveals that having an increased level of regional new business formation may not immediately lead to growth but, instead, to a revolving-door regime with a considerable likelihood of becoming an entrepreneurial regime after some time. If regions have succeeded in establishing an entrepreneurial regime, the regime may prove to be stable and persistent. A number of empirical analyses demonstrate that the stability of a region's entrepreneurial orientation may be self-perpetuating and, therefore, persistent over long periods of time (Andersson and Koster 2011; Fritsch and Mueller 2007; Fritsch and Wyrwich 2014a). The reasons for this phenomenon are no doubt manifold and as yet only partly understood. Possibly, regions with a relatively high number of start-ups provide many entrepreneurial role models that stimulate further new businesses (Bosma et al. 2012). Moreover, entrepreneurial regions tend to have a high share of employment in small firms, a situation with a great deal of potential for enhanced entrepreneurship. High levels of new business formation, particularly if in new markets, can also generate relatively many entrepreneurial opportunities that induce start-ups. Last, but not least, a regional culture of entrepreneurship may emerge, one characterized by a high level of social acceptance of self-employment entrepreneurship and a rich supporting infrastructure.

The life-cycle model reveals a danger that regions with an entrepreneurial regime may in the long-run become victim of their own success. The constant inflow of new firms with new ideas makes it quite likely that some of these start-ups will grow and become large firms, with the possible consequence that the regional level of entrepreneurship will decrease. For example, the growth of successful firms leads to a decline in the share of small firm employment that constitutes an important

⁹ The development in some regions of Baden-Wuerttemberg (Germany), for example, the region of Stuttgart, may be viewed as an example of such development.

seedbed for new businesses. This may reduce the local workforce's propensity to engage in start-ups. Moreover, good availability of well-paid jobs in large firms may make secure dependent employment more preferable to risky self-employment for some would-be entrepreneurs. The region's entrepreneurial spirit may thus wane, resulting in transition to a routinized regime. This is especially likely if the region is dominated by one or a few large firms. Once having reached the stage of a routinized regime, a region loses variety and becomes vulnerable to external shocks. If the innovativeness of the region's established firms declines or market demand falls, the region may become an old industrialized area with low entry rates and below-average employment growth or even decline, that is, it will become host to a downsizing growth regime. Obviously, a key task for policy in the lifecycle is the establishment and preservation of an entrepreneurial culture that is characterized by high levels of new business formation. The life-cycle model suggests that this is particularly the appropriate strategy for regions with a downsizing regime. This may also be the best way to prevent regions with a routinized regime from becoming downsizing. Empirical evidence suggests that innovation and particularly diversification of the industry structure through entrepreneurial discovery are promising ways by which routinized regions may escape this possible threat (Neffke, Henning and Boschma 2011; Noseleit 2013).

8. Implications for policy and for further research

In our analysis we distinguished between four types of regional growth regimes based on the relationship between new business formation and economic development. To identify the reasons for the different growth performance, we analyzed several characteristics to discover if there are distinctive regional aspects that make it more likely a certain region will have a certain type of growth regime. The results show that extent of the regional knowledge base, R&D intensity, the diversity of and entry-induced change in regional industry structure, and a region's general entrepreneurial environment are distinct across different growth regimes. The importance of these factors became particularly clear when

comparing regime types that have similar intensity of start-up activity, namely, entrepreneurial and revolving-door regimes and routinized and downsizing regimes.

In investigating the development patterns of the four growth regime types over time we found that while the downsizing as well as entrepreneurial growth regimes tend to be rather stable over time, the other two types appear to be of a more transitory nature. We identified typical transition patterns between the regime types that indicate relatively long-term positive effects of new business formation on regional development.

All in all, our analysis suggests that entrepreneurship in terms of new business formation is an important resource for initiating and safeguarding economic prosperity under all conditions, that is, for all growth regime types. It may take a great deal of effort to make a region more entrepreneurial, but the reward may be longlasting. Regions home to prospering large firms should try particularly hard to preserve and intensify their entrepreneurial spirit.

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Appendix

Table A1: Descriptive statistics (All regime types)

<i>Indicator</i>	<i>Number of observations</i>	<i>Mean</i>	<i>Median</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Standard deviation</i>
Share of highly qualified workforce	497	0.056	0.050	0.015	0.185	0.026
Share of private sector R&D employment	497	0.024	0.022	0.004	0.074	0.013
Survival rates of new businesses	497	0.573	0.570	0.489	0.690	0.036
Employment share of small businesses	497	0.294	0.288	0.191	0.480	0.052
Self-employment rate	497	0.096	0.093	0.059	0.166	0.017
Similarity of industry structure between entries and exits	497	0.967	0.971	0.861	0.993	0.018
Level of industry diversity	497	0.852	0.855	0.781	0.895	0.024
Related variety	497	1.497	1.513	0.985	1.820	0.151
Unrelated variety	497	4.384	4.408	3.771	4.674	0.147
Share of KIBS employment	497	0.048	0.026	0.007	0.314	0.056
Population density (log)	497	5.405	5.263	4.220	7.125	0.667

Table A2: Descriptive statistics (Entrepreneurial regime)

<i>Indicator</i>	<i>Number of observations</i>	<i>Mean</i>	<i>Median</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Standard deviation</i>
Share of highly qualified workforce	108	0.054	0.043	0.016	0.185	0.031
Share of private sector R&D employment	108	0.023	0.018	0.004	0.074	0.014
Survival rates of new businesses	108	0.578	0.572	0.503	0.685	0.038
Employment share of small businesses	108	0.323	0.322	0.216	0.480	0.057
Self-employment rate	108	0.104	0.102	0.070	0.159	0.018
Similarity of industry structure between entries and exits	108	0.964	0.970	0.861	0.992	0.021
Level of industry diversity	108	0.853	0.857	0.790	0.890	0.025
Related variety	108	1.482	1.487	1.088	1.789	0.143
Unrelated variety	108	4.394	4.399	4.074	4.627	0.127
Share of KIBS employment	108	0.044	0.025	0.010	0.310	0.050
Population density (log)	108	5.253	5.121	4.220	7.045	0.614

Table A3: Descriptive statistics (Revolving-door regime)

<i>Indicator</i>	<i>Number of observations</i>	<i>Mean</i>	<i>Median</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Standard deviation</i>
Share of highly qualified workforce	131	0.061	0.057	0.019	0.149	0.027
Share of private sector R&D employment	131	0.026	0.025	0.007	0.061	0.012
Survival rates of new businesses	131	0.552	0.549	0.489	0.622	0.028
Employment share of small businesses	131	0.314	0.309	0.207	0.469	0.058
Self-employment rate	131	0.102	0.100	0.067	0.166	0.020
Similarity of industry structure between entries and exits	131	0.974	0.976	0.907	0.993	0.015
Level of industry diversity	131	0.844	0.846	0.785	0.895	0.024
Related variety	131	1.514	1.535	1.130	1.820	0.161
Unrelated variety	131	4.373	4.386	4.042	4.603	0.133
Share of KIBS employment	131	0.061	0.032	0.014	0.314	0.070
Population density (log)	131	5.572	5.438	4.234	7.125	0.762

Table A4: Descriptive statistics (Routinized regime)

<i>Indicator</i>	<i>Number of observations</i>	<i>Mean</i>	<i>Median</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Standard deviation</i>
Share of highly qualified workforce	137	0.053	0.050	0.015	0.130	0.024
Share of private sector R&D employment	137	0.024	0.020	0.005	0.064	0.013
Survival rates of new businesses	137	0.589	0.589	0.514	0.690	0.036
Employment share of small businesses	137	0.279	0.282	0.191	0.344	0.030
Self-employment rate	137	0.093	0.092	0.064	0.127	0.011
Similarity of industry structure between entries and exits	137	0.963	0.966	0.905	0.989	0.016
Level of industry diversity	137	0.861	0.864	0.800	0.895	0.021
Related variety	137	1.496	1.527	1.001	1.727	0.151
Unrelated variety	137	4.410	4.435	3.771	4.663	0.147
Share of KIBS employment	137	0.048	0.027	0.007	0.207	0.050
Population density (log)	137	5.201	5.130	4.431	6.572	0.474

Table A5: Descriptive statistics (Downsizing regime)

<i>Indicator</i>	<i>Number of observations</i>	<i>Mean</i>	<i>Median</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Standard deviation</i>
Share of highly qualified workforce	121	0.053	0.048	0.021	0.145	0.022
Share of private sector R&D employment	121	0.025	0.023	0.009	0.069	0.011
Survival rates of new businesses	121	0.571	0.567	0.500	0.671	0.033
Employment share of small businesses	121	0.264	0.267	0.197	0.368	0.036
Self-employment rate	121	0.085	0.084	0.059	0.128	0.013
Similarity of industry structure between entries and exits	121	0.967	0.971	0.876	0.990	0.019
Level of industry diversity	121	0.848	0.851	0.781	0.892	0.023
Related variety	121	1.496	1.505	0.985	1.767	0.148
Unrelated variety	121	4.356	4.357	3.807	4.674	0.173
Share of KIBS employment	121	0.039	0.023	0.010	0.246	0.049
Population density (log)	121	5.592	5.394	4.564	7.074	0.698

Table A6: Correlation matrix

Indicator	I	II	III	IV	V	VI	VII	VIII	IX	X
I Share of highly qualified workforce	1.00									
II Share of private sector R&D employment	0.904*	1.00								
III Survival rates of new businesses	-0.424*	-0.372*	1.00							
IV Employment share of small businesses	-0.297*	-0.369*	-0.056	1.00						
V Self-employment rate	-0.091*	-0.192*	-0.054	0.877*	1					
VI Similarity of industry structure between entries and exits	0.339*	0.305*	-0.470*	-0.08	-0.082	1.00				
VII Level of industry diversity	-0.277*	-0.175*	0.324*	-0.07	-0.059	-0.155*	1.00			
VIII Related variety	0.505*	0.388*	-0.396*	0.018	0.171*	0.334*	-0.146*	1.00		
IX Unrelated variety	0.299*	0.323*	0.012	-0.154*	-0.079	0.087	0.663*	0.329*	1.00	
X Share of KIBS employment	0.613*	0.469*	-0.284*	-0.002	0.215*	0.220*	-0.327*	0.477*	0.063	1.00
XI Population density (log)	0.561*	0.537*	-0.436*	-0.520*	-0.527*	0.417*	-0.150*	0.371*	0.243*	0.206*

Note: * statistically significant at the 5% level.

Table A7: Correlation matrix

Indicator (regime type)	I	II	III	IV	V	VI	VII
I Entrepreneurial	1.000						
II Revolving door	-0.318*	1.000					
III Routinized	-0.326*	-0.349*	1.000				
IV Downsizing	-0.318*	-0.339*	-0.349*	1.000			
V Entrepreneurial (t-1)	0.176*	0.170*	-0.098*	-0.243*	1.000		
VI Revolving door (t-1)	0.301*	0.212*	-0.274*	-0.224*	-0.317*	1.000	
VII Routinized (t-1)	-0.221*	-0.293*	0.370*	0.129	-0.327*	-0.344*	1.000
VIII Downsizing (t-1)	-0.242*	-0.087*	0.001	0.322*	-0.323*	-0.339*	-0.349*

Note: * statistically significant at the 5% level

Table A8: Transition probabilities of the regional growth regimes across time periods

<i>Regime type in 1976-84, 1985-93, 1994-02</i>	<i>Regime type in 1985-93, 1994-02, 2003-11</i>							
	<i>Entrepreneurial</i>		<i>Revolving-door</i>		<i>Routinized</i>		<i>Downsizing</i>	
	Cases	%	Cases	%	Cases	%	Cases	%
<i>Entrepreneurial</i>	9	39%	7	30%	5	22%	2	9%
	9	45%	6	30%	3	15%	2	10%
	8	42%	7	37%	3	16%	1	5%
Av.transition probability		42%		32%		18%		8%
<i>Revolving-door</i>	7	58%	5	42%	0	0%	0	0%
	8	53%	4	27%	0	0%	3	20%
	2	13%	11	69%	2	13%	1	6%
Av.transition probability		41%		46%		4%		9%
<i>Routinized</i>	1	8%	1	8%	4	33%	6	50%
	1	7%	0	0%	6	40%	8	53%
	1	6%	0	0%	11	69%	4	25%
Av.transition probability		7%		3%		47%		43%
<i>Downsizing</i>	3	13%	3	13%	5	21%	13	54%
	1	5%	6	29%	7	33%	7	33%
	0	0%	6	30%	8	40%	6	30%
Av.transition probability		6%		24%		31%		39%

First row: change between 1976-84 and 1985-93, second row: change between 1985-93 and 1994-2002, third row: change between 1994-02 and 2003-2011, fourth row: average transition probability

Table A9: Characteristics of regimes: Mean values and t-test of equal means

<i>Indicator</i>	<i>Full sample</i>	<i>Entrepreneurial vs. revolving door</i>	<i>Entrepreneurial vs. routinized</i>	<i>Entrepreneurial vs. downsizing</i>	<i>Revolving door vs. routinized</i>	<i>Revolving door vs. downsizing</i>	<i>Routinized vs. downsizing</i>
Share of highly qualified workforce	0.055	0.054**	1.054	2.054	0.061***	0.061***	0.053
Share of private sector R&D employment	0.024	0.023**	0.023	0.023*	0.026**	0.026	0.024
Survival rates of new businesses	0.574	0.578**	0.578	0.578*	0.552**	0.552	0.589
Employment share of small businesses	0.295	0.323	0.323***	0.323***	0.314***	0.314***	0.279***
Self-employment rate	0.096	0.104	0.104***	0.104***	0.102***	0.102***	0.093***
Similarity of industry structure between entries and exits	0.967	0.964***	0.964	0.964	0.974***	0.974***	0.963**
Level of industry diversity	0.851	0.853***	1.853***	2.853*	0.844***	0.844	0.861***
Related variety	1.499	1.482*	1.482	1.482	1.514	1.514	1.496
Unrelated variety	4.384	4.394	4.394	4.394**	4.373**	5.373	4.410***
Share of KIBS employment	0.049	0.044**	0.044	0.044	0.061**	0.061***	0.048*
Population density (log)	5.406	5.253***	5.253	5.253***	5.572***	5.572	5.201***
Number of observations	497	108	108	108	131	131	137

Notes: Asterisks for each regime type indicate that the mean value of the particular regime type is statistically different from the mean value of the other type of regime. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

Table A10: Distinctive characteristics of regional growth regimes (marginal effects)

<i>Indicator</i>	<i>Entrepreneurial</i>	<i>Revolving door</i>	<i>Routinized</i>	<i>Downsizing</i>
Share of highly qualified workforce	6.05*** (1.63)	-0.88 (1.85)	2.51 (2.27)	-7.54*** (2.40)
Survival rates of new businesses	1.78** (0.76)	-2.95*** (0.85)	2.08*** (0.79)	-1.04 (0.75)
Employment share of small businesses	4.59*** (0.61)	2.50*** (0.64)	-3.22*** (0.73)	-6.01*** (1.14)
Similarity of industry structure between entries and exits	-1.87* (0.99)	2.14 (1.33)	0.92 (1.12)	-0.48 (1.05)
Level of industry diversity	2.56** (1.24)	0.1 (1.38)	2.63** (1.20)	-1.9 (1.27)
Share of KIBS employment	-1.09 (1.45)	2.48* (1.49)	-3.19 (2.03)	2.16 (1.56)
Population density (log)	0.18** (0.07)	0.16** (0.07)	-0.28*** (0.08)	-0.03 (0.08)
Year dummies	Yes**	Yes	Yes***	Yes
Federal State dummies	Yes***	Yes	Yes	Yes
Number of observations	497	497	497	497
Log likelihood	-185.66	-200.55	-186.62	-187.43
chi2	53.22	63.66	60.67	35.83

Notes: Dependent variable: First mentioned regime (= 1) versus rest of regimes (= 0). Random effects probit regressions, standard errors in parentheses. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

Table A11: Distinctive characteristics of regional growth regimes (marginal effects; share of private-sector R&D employment applied)

<i>Indicator</i>	<i>Entrepre- neurial vs. revolving door</i>	<i>Entrepre- neurial vs. routinized</i>	<i>Entrepre- neurial vs. downsizing</i>	<i>Revolving door vs. routinized</i>	<i>Revolving door vs. downsizing</i>	<i>Routinized vs. downsizing</i>
Share of private sector R&D employment	4.31 (4.17)	4.67 (4.28)	9.19 (6.35)	0.49 (2.84)	8.99* (4.87)	13.24* (6.94)
Survival rates of new businesses	5.50*** (1.45)	0.05 (1.06)	1.09 (0.94)	-3.09** (1.53)	-2.78** (1.09)	3.46** (1.38)
Employment share of small businesses	2.22* (1.18)	8.07*** (1.22)	9.94** (3.98)	6.31** (2.78)	9.53*** (2.09)	3.19 (2.01)
Similarity of industry structure between entries and exits	-3.98* (2.14)	-1.79 (1.37)	-0.54 (0.81)	0.38 (0.92)	0.35 (1.40)	0.41 (2.02)
Level of industry diversity	2.52 (2.29)	-2.41 (1.83)	2.4 (2.14)	-3.39 (2.92)	0.54 (2.41)	3.77* (2.09)
Share of KIBS employment	1.27 (2.02)	0.64 (2.51)	1.99 (2.83)	3.05 (1.91)	2.65 (2.03)	-3.95 (3.21)
Population density (log)	0.1 (0.12)	0.45*** (0.13)	0.29** (0.14)	0.27* (0.14)	0.32** (0.16)	-0.21 (0.14)
Year dummies	Yes	Yes*	Yes	Yes	Yes*	Yes
Federal State dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	239	245	229	268	252	258
Log likelihood	-132.95	-71.33	-56.24	-70.8	-71.86	-128.44
Chi2	42.15	17.04	14.2	25.77	16.73	27.31

Notes: Dependent variable: First mentioned regime (= 1) versus second mentioned regime (= 0). Random effects probit regressions, standard errors in parentheses. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

Table A12: Distinctive characteristics of regional growth regimes (marginal effects; self-employment rate instead of share of small firm employment applied)

<i>Indicator</i>	<i>Entrepreneurial vs. revolving door</i>	<i>Entrepreneurial vs. routinized</i>	<i>Entrepreneurial vs. downsizing</i>	<i>Revolving door vs. routinized</i>	<i>Revolving door vs. downsizing</i>	<i>Routinized vs. downsizing</i>
Share of highly qualified workforce	5.91** (2.75)	5.23* (3.01)	12.41*** (3.50)	-8.91*** (2.41)	7.60** (3.62)	16.00*** (4.70)
Survival rates of new businesses	5.58*** (1.44)	0.03 (0.90)	0.14 (0.94)	-2.44* (1.36)	-2.74** (1.07)	3.31** (1.37)
Self-employment rate	4.81 (3.73)	29.74*** (5.00)	36.53*** (9.18)	13.06*** (3.35)	44.12*** (6.31)	12.51* (7.33)
Similarity of industry structure between entries and exits	-3.26 (2.12)	-1.11 (1.15)	0.19 (0.91)	6.01** (2.69)	1.23 (1.40)	0.13 (1.99)
Level of industry diversity	2.45 (2.25)	-2.69* (1.58)	0.52 (1.63)	-7.59*** (2.21)	-0.94 (2.15)	4.23** (2.06)
Share of KIBS employment	-1.57 (2.48)	-1.55 (2.78)	-3.54 (3.22)	-0.55 (0.72)	2.49 (3.08)	-9.20** (3.79)
Population density (log)	-0.02 (0.13)	0.42*** (0.09)	0.25* (0.13)	0.51*** (0.13)	0.42*** (0.12)	-0.30* (0.16)
Year dummies	Yes	Yes*	Yes*	Yes	Yes	Yes*
Federal State dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	239	245	229	268	252	258
Log likelihood	-131.91	-59.7	-47.92	-76.2	-58.03	-124.65
Chi2	42.1	13.43	14.56	23.36	14.77	27.57

Notes: Dependent variable: First mentioned regime (= 1) versus second mentioned regime (= 0). Random effects probit regressions, standard errors in parentheses. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

Table A13: Distinctive characteristics of regional growth regimes (marginal effects; related and unrelated variety instead of industry variety applied)

<i>Indicator</i>	<i>Entrepre- neurial vs. revolving door</i>	<i>Entrepre- neurial vs. routinized</i>	<i>Entrepre- neurial vs. downsizing</i>	<i>Revolving door vs. routinized</i>	<i>Revolving door vs. downsizing</i>	<i>Routinized vs. downsizing</i>
Share of highly qualified workforce	5.41** (2.45)	6.57** (3.15)	2.75 (1.97)	-2.43 (3.97)	6.75* (3.63)	15.12*** (4.82)
Survival rates of new businesses	5.61*** (1.40)	-0.17 (1.03)	2.60*** (0.88)	-4.67*** (1.39)	-2.93*** (1.11)	3.36** (1.41)
Employment share of small businesses	1.29 (1.04)	8.96*** (1.35)	8.44*** (1.18)	8.02*** (2.49)	10.19*** (2.01)	4.17** (1.99)
Similarity of industry structure between entries and exits	-4.65** (2.08)	-1.55 (1.33)	0.07 (1.07)	1.54 (1.86)	0.57 (1.45)	0.64 (2.04)
Related variety	0.71** (0.35)	-0.29 (0.35)	-0.81*** (0.25)	-0.67* (0.37)	-0.36 (0.38)	-0.23 (0.48)
Unrelated variety	-0.06 0.31	-0.49* (0.30)	0.64** (0.28)	-0.51** (0.26)	0.32 (0.33)	0.43 (0.34)
Share of KIBS employment	-2.68 (2.40)	-2.21 (2.91)	-0.06 (0.58)	6.04 (4.31)	0.63 (2.29)	-10.11*** (3.85)
Population density (log)	-0.01 (0.11)	0.47*** (0.14)	0.17* (0.10)	0.47*** (0.16)	0.34** (0.15)	-0.31* (0.16)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes*
Federal State dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	239	245	229	268	252	258
Log likelihood	-129.18	-67.49	-68.82	-65.75	-70.82	-125.25
Chi2	50.17	16.34	22.63	29.54	16.1	27.94

Notes: Dependent variable: First mentioned regime (= 1) versus second mentioned regime (= 0). Random effects probit regressions, standard errors in parentheses. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

Table A14: Distinctive characteristics of regional growth regimes (marginal effects; 3 percent of observations around medians excluded)

<i>Indicator</i>	<i>Entrepreneurial vs. revolving door</i>	<i>Entrepreneurial vs. routinized</i>	<i>Entrepreneurial vs. downsizing</i>	<i>Revolving door vs. routinized</i>	<i>Revolving door vs. downsizing</i>	<i>Routinized vs. downsizing</i>
Share of highly qualified workforce	4.83* (2.79)	-5.2** (2.64)	4.59** (2.07)	-3.67 (3.88)	2.41 (2.41)	10.20** (4.69)
Survival rates of new businesses	6.24*** (1.69)	0.94 (1.02)	3.39** (1.38)	-1.53 (1.67)	-1.27 (1.17)	3.16** (1.38)
Employment share of small businesses	2.53** (1.21)	5.70*** (1.47)	7.58*** (2.70)	6.64*** (2.36)	7.43*** (1.19)	4.87** (2.00)
Similarity of industry structure between entries and exits	-3.08 (2.34)	-0.23 (1.54)	3.05 (3.29)	1.09 (3.06)	3.83* (2.03)	-0.15 (2.15)
Level of industry diversity	1.35 (2.51)	-1.37 (1.85)	0.26 (1.42)	-5.24 (3.55)	-0.76 (2.05)	2.49 (2.03)
Share of KIBS employment	-1.58 (2.83)	-0.36 (0.64)	-1.65* (0.85)	-0.17 (0.82)	-0.67 (0.69)	-5.13 (3.68)
Population density (log)	0.14 (0.13)	0.60*** (0.17)	0.16 (0.10)	0.57*** (0.14)	0.16* (0.09)	-0.28* (0.15)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Federal State dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	200	204	183	220	199	203
Log likelihood	-113.97	-100.96	-80.84	-69.42	-88.98	-97.1
Chi2	34.81	26.74	30.97	18.14	19.88	25.71

Notes: Dependent variable: First mentioned regime (= 1) versus second mentioned regime (= 0). Random effects probit regressions, standard errors in parentheses. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.