

Noseleit, Florian

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Market Selection and Regional Diversification - Empirical Regularities from German Panel-Data

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Market Selection and Regional Diversification - Empirical Regularities from German Panel-Data

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Abstract

Several empirical studies demonstrate that regional industry diversity can be beneficial for local growth. This paper analyzes how regional diversity evolves over time. Focusing on the development of diversity in entry cohorts over 27 years using data for West German regions, we find that (I) total diversity at the national level remains rather stable or, at most, slightly decreases over time while (II) total regional diversity increases due to market entry. Among the entry cohorts, (III) selection increases diversity at the macro level but (IV) decreases diversity within regions (*industry specialization within regions*). This antipodal observation can be explained by a simple process of regional specialization in which (V) market selection decreases similarity in the industry structure of entries between regions (*industry specialization between regions*), while (VI) entries increase regional diversity due to a selection that favors less similar entries in comparison to the initial industry structure in the region. The stability of regional diversity indicates an equilibrium phenomenon with no dominant role for historical accidents.

JEL classification: R11, R12, L11, O11

Keywords: Diversity, Specialization, Entries, Market Selection

Address for correspondence:

Florian Noseleit

*Friedrich-Schiller-University Jena
School of Economics and Business Administration
Carl-Zeiss-Str. 3
D-07743 Jena
Phone: ++49 (0) 3641- 943226*

florian.noseleit@uni-jena.de

1 Introduction

Several theoretical approaches to explaining economic growth focus on externalities arising from interactions between economic agents. A frequently discussed source of such externalities is regional diversity of the industry structure. A large number of empirical studies support the argument that regional diversity can be beneficial to regional employment, innovation, and economic stability (Andersson et al. 2005; Combes 2000; Feldman and Audretsch 1999; Glaeser et al. 1992).

It is not particularly surprising that diversity in the industry structure can be assumed to depend, in part, on the activity of new businesses entering the market. To date, however, little is known about the roles and paths new businesses take in the diversification of the industry structure. The central questions that this paper attempts to answer are how the market selection process influences the diversity of entries and how start-up activity influences diversity in the region and beyond. For an analysis of diversity patterns, we use regional data for West Germany over a 27-year period that includes specifics about employment at the industry level and allows us to distinguish and follow entry cohorts over time.

Our results can be summarized as follows. On the whole, regional diversity moderately increased over the last decades. Regional diversity and region size are related via an inverse u-shape. Establishment scale, measured as the share of employees working in large businesses, is negatively related to diversity. In addition, evidence supports that regional diversity increases with the number of entries but decreases with the number of exits. Industry specialization in manufacturing and services is positively associated with diversity. The role entries play in the regional dynamics of diversity gives evidence of certain empirical regularities. Employment diversity in entries is increasing over time at the national level, while diversity at the regional level is decreasing for the average region. This antipodal development of diversity can be explained by a market selection favoring a diverse set of specializations at the regional level. Despite the decrease in regional diversity in entry cohorts over time, these entries contribute to an increase in total

regional diversity due to a selection within entry cohorts that substantially differs from the existing regional industry structure.

The paper is structured as follows. Section 2 discusses the theoretical background and related literature. A description of the dataset is presented in section 3. Section 4 analyzes the determinants of regional diversity, and section 5 examines diversity patterns at the national and the regional level. Section 6 contains a brief discussion of various conclusions and suggestions for areas of further research.

2 Related Literature and Theoretical Background

Several empirical studies demonstrate the importance of a diversified regional industry structure for certain desired results. One of the most prominent articles to examine the composition of economic activity was written by Glaeser et al. (1992), who conclude that diversity is beneficial for employment growth. This result has been replicated in a number of studies in various countries. Blien and Südekum (2005) in West Germany and Combes (2000) in France reveal Jacobs externalities to be positively associated with local growth in service industries. However, some empirical findings question the beneficial nature of industry diversity. Using data from US-metropolitan areas, Henderson et al. (1995) only find select evidence for Jacobs externalities in high-tech industries and not at all for traditional industries. In their study of regions of Italy, Cingano and Schivardi (2004) argue that externalities first and foremost influence productivity. They come to the conclusion that diversified regions experience higher employment growth but less expansion of productivity. These findings thus suggest that results based on employment growth are dependent upon whether productivity changes are labor-saving or enhancing. The relationship between productivity changes and employment growth, however, is not constant. Using data for 25 OECD countries, Cavelaars (2005) finds evidence that the relationship between productivity growth and job growth between 1960 and 1980 was negative, but positive between 1980 and 2000. Therefore, the Italian case may simply be an exception. The suggested mechanism linking diversity and growth is based on knowledge spillovers between industries, so called Jacobs

externalities. This more direct mechanism is examined by Feldman and Audretsch (1999), who determine diversity rather than specialization as beneficial to the introduction of innovations. In Sweden, Andersson et al. (2005) associate a diverse regional employment structure with higher patenting rates. Another recurrent finding in the empirical literature is a relation between diversity and economic stability (e.g. Brewer and Moomaw 1985; Conroy 1975; Kort 1981; Malizia and Ke 1993). Finally, several studies deal with the relationship between economic diversity and regional income. The empirical results in this regard are mixed. Lynch (1979) finds no relationship between diversity and per capita income, Attaran (1986) observes a negative correlation between income and diversity, and Wagner and Deller (1998) determine higher levels of diversity to be positively related to income growth. The general picture suggests that diversity is indeed beneficial for several desired outcomes, including regional economic stability, although many unanswered questions related to numerous outcome variables, such as productivity and employment growth and income, remain.

Compared with the large amount of literature analyzing whether diversity or specialization is conducive to regional development, the literature discussing trends of regional diversification is rather limited. However, several studies analyze the dynamics of the geographic concentration of industries. This literature can be regarded as a good starting point for our analysis of regional dynamics of diversity. Dumais et al. (2002) examine the dynamics of geographic concentration for U.S. manufacturing industries between 1972 and 1992. A decomposition of aggregate concentration changes show that new firm location choices reduce geographic concentration of industries. This result is confirmed by Barrios et al. (2005) for Irish and Portuguese manufacturing firms. In an analysis of geographical concentration and establishment size, Barrios et al. (2006) conclude that the positive relation between concentration and establishment size (as described, for instance, by Holmes and Stevens 2002) is much weaker for entries but becomes stronger over time. Barrios et al. discover some evidence that this establishment age effect of geographical concentration can be attributed to entry into industries that grow over time. Südekum (2006) analyzes concentration and specialization trends for German

regions after re-unification and finds no indication of specialization of regions or concentration of industries. Instead, he uncovers hints of an opposite trend, namely one of de-concentration and de-specialization. In contrast to the literature focusing on the geographical concentration of industries, we concentrate on regions and their trends in the employment structure of industries. Thus, the main focus of this paper is not to analyze forces of agglomeration, but rather to investigate the dynamics of regional diversity itself, with a particular emphasis on the role of entries and the process of market selection. In this context, it should be noted that regional specialization in some industries often goes hand in hand with relatively high diversity as well and is therefore not a knockout criterion (compare Duranton and Puga 2000). To the best of our knowledge, no study has aimed directly at the particular topic of the dynamics of industry diversity by tracking regional entry cohorts over time.

3 Data

The data used in this analysis was derived from the Establishment History Panel,¹ available at the Institute for Employment Research (IAB) of the German Federal Employment Agency.² This data set contains establishment aggregate data that allows for the analysis of regionally based research questions. Since the data is based on official employment statistics derived from social security information, it can be regarded as highly reliable. The units of observation are 326 NUTS3 West German regions (Landkreise), which are roughly comparable to U.S. counties.³ We chose these relatively small geographical entities because larger spatial units might automatically increase diversity, especially when focusing on large functional geographic units. Thus, concentrating on relatively small spatial units increases the probability of detecting functional specializations no longer observable in larger geographic units. Furthermore, more geographically disaggregate data reduces

² Civil servants and self-employed individuals are not incorporated in our data since they are not subject to social security coverage.

³ We limit our analysis to West Germany because of a lack of reliable data and the specific conditions for East German regions after reunification.

measurement error. Data is available for the 1975 to 2002 period without changes in the underlying industry classification. The industry classification used for this study distinguishes approximately 290 industries. After 2002, the old classification was no longer reported and was replaced by a new classification system. Thus, we decided not to use any data collected after 2002. One disadvantage of this data set is that it does not distinguish real entry from changes in property rights or relocation.⁴

4 Determinants of regional diversity

In this section, we briefly discuss the determinants of regional diversity, primarily in order to link the literature on geographical concentration discussed in the previous section more directly to regional diversity. First of all, what is known about regional diversity is that larger cities tend to be more diversified (Brewer and Moomaw 1985, Duranton and Puga 2000). However, diversity does not seem to increase linearly with size. In a study focusing on medium sized cities, Henderson (1997) reveals large cities as tending towards greater specialization than medium-sized cities. This finding suggests that the relationship between diversity and city size can be described by an inverted U-shaped structure. Next, the investigations of Dumais et al. (2002) and Barrios et al. (2005), which indicate that new businesses tend to reduce geographic concentration and benefit more from Jacobs externalities, lead us to expect entries to have a positive impact on regional diversity. On the other hand, plant closures have been identified as reinforcing geographic concentration, thereby suggesting that exits are negatively associated with regional diversity. This conclusion is in line with results based on a very detailed data set on French establishments by Duranton and Puga (2001), which demonstrate that most new establishments were created in regions with above-median diversity. In a study linking geographic concentration to establishment scale, Holmes and Stevens (2002) find a positive correlation between concentration and establishment scale in the United States, since establishment in the respective industry is larger in regions in

⁴ In an unpublished study based on German social insurance data as well, Hethey and Schmieder (2009) show that only around 1.7 % of all entries are ID changes (for example, due to property right changes). Thus, the error due to ID changes in the data is relatively small.

which the industry is concentrated. This finding was confirmed by Barrios et al. (2006) in Ireland. Therefore, we expect the regional establishment size structure to be negatively correlated to diversity. Finally, how the regional specialization in certain industries is related to regional diversity is of great importance. This relationship is not self-evident, as the spatial concentration of single industries does not automatically create a less diversified region. On the contrary, regions with certain specialized industries can still encompass a broad base of other industries and can thus be both diversified and specialized (Duranton and Puga 2000). For example, Henderson (1997) argues that large metropolitan areas are often specialized (in finance, advertising, and consulting, for instance), while possessing a highly diversified manufacturing base at the same time. Malizia and Ke (1993) also note that diversity in a region can be the result of multiple specializations (specialized diversity). Thus, it should be noted that diversity is not the flipside of specialization, although several studies treat it as though it were. This idea is translated into the concept of diversified specializations by Dissart (2003), who argues that clusters can also be seen as sources of economic diversity. In Table A1 in the Appendix, the regions with the highest and lowest values for diversity, as well as the total number of industries in which they specialize, are reported for the years 1975, 1985, 1995, and 2002. Regional specialization is quantified as the number of industries in which the Location Quotient is larger than 1. The Location Quotient measures the regional share of employment in an industry relative to the industry employment share at the national level. In order to avoid bias due to specializations in a number of small but related industries, the measure of industry specialization is based on 28 aggregated industries (rather than the 3 digit industry level). Diversification turns out to be strongly persistent. Not only is the correlation between diversity in 1975 and diversity in 2002 for all 326 regions very high (around 0.7), but there are also four regions belonging to the top ten diversified regions in 2002 that were already in the top ten in 1975, with seven out of ten regions with the lowest diversity reappearing in 2002 as well. Regions with the lowest diversification contain only a few specialized industries, but are highly specialized in these industries. Erlangen (office supplies & IT) and Wolfsburg (automobiles), for instance, only have one specialized industry dominated by large incumbents. Thus,

regions with the lowest levels of diversification barely have any specialization in services, while regions with high levels of diversification seem to have a greater number of industries in which they specialize, both in manufacturing and services. However, specialization in regions with high diversity levels is not as dominant as in low diversity regions. Therefore, regions with high levels of diversity have more industries in which they are specialized, while at the same time being less concentrated. Since those regions with the highest levels of diversity and moderately above average specialization are not the very large metropolitan areas that Henderson (1997) had in mind, Dissart's (2003) concept of diversified specializations appears an apt description of regions with very high levels of diversity. Based on these descriptions, it seems plausible to expect that specializations in some industries, provided they remain modest, are positively related to diversity. Table 4-1 gives an overview of regional characteristics and their assumed relation to diversity.

Table 4-1: Regional characteristics and their relation to diversity.

Variable (related study in the geographic concentration literature)	Definition	Relation to regional diversity
Entries (Dumais et al. 2002)	Number of entries (in thousands)	Positive
Exits (Dumais et al. 2002)	Number of exits (in thousands)	Negative
Regional specialization (overall, manufacturing, services) (Dissart 2003; Henderson 1997,)	Number of industries (all industries, manufacturing, services) in which a region has a Location Quotient greater than 1	Negative or positive
Region size (Duranton and Puga 2000; Henderson 1997)	log Employment (and squared term)	Positive (at a decreasing rate), Inverted u-shape?
Establishment scale (Holmes and Stevens 2002)	Share of employees working in businesses with more than 200 employees	Negative

Note: The Location Quotient measures the regional share of employment in an industry relative to the industry employment share at the national level. Industry specialization is based on 28 aggregated industries.

In Table 4-2, we report regression results for relative regional diversity on the variables described in Table 4-1. Relative regional diversity is calculated as the inverse relative Herfindahl $1/\sum rs_i^2$, where rs is defined as the region's share of industry i relative to the national share of the respective industry. The estimations are based on the following equation

$$\text{Relative regional diversity}_{r,t} = \alpha + \mu_r + \lambda_t + \gamma X_{r,t-1} + \varepsilon_{r,t}$$

for region r in time t , where $X_{r,t-1}$ is a set of one year lagged variables that are assumed to be related to regional diversity, μ_r is a regional fixed effect, λ_t a time fixed effect, and $\varepsilon_{r,t}$ is the error term. Regional fixed effects are included to consider persistent regional characteristics (for example, whether a region is located by the sea, natural resources, or a central location in space). We also consider the employment shares of 27 out of 28 aggregated industries, since changes in diversity may be dependent on the initial industry structure of a region and thus might influence the coefficients of our variables of interest.

Table 4-2: Determinants of diversity

Dependent variable: Relative regional diversity					
Independent variable	I	II	III	IV	V
Entries	–	–	–	0.00701** (0.0032)	0.00122 (0.0027)
Exits	–	–	–	-0.0428** (0.019)	0.00120 (0.015)
Regional specialization (overall)	–	0.0119*** (0.0013)	–	–	–
Regional specialization (manufacturing)	–	–	0.0154*** (0.0022)	0.0149*** (0.0022)	0.0100*** (0.0020)
Regional specialization (services)	–	–	0.00585** (0.0023)	0.00571** (0.0023)	0.00272 (0.0021)
Establishment scale	-0.616*** (0.081)	-0.533*** (0.072)	-0.589*** (0.077)	-0.599*** (0.077)	-0.464*** (0.067)
Region size	0.935*** (0.34)	0.804** (0.32)	0.897*** (0.33)	0.874*** (0.32)	1.002*** (0.27)
Region size squared	-0.0463*** (0.016)	-0.0394*** (0.015)	-0.0443*** (0.016)	-0.0431*** (0.015)	-0.0441*** (0.013)
Constant	-3.853** (1.79)	-3.404** (1.64)	-3.765** (1.70)	-3.755** (1.68)	-5.347*** (1.47)
Control for regional industry structure	No	No	No	No	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Log-likelihood	14794	15105	15003	15017	15758
F-Test	49.65 (0.00)	56.19 (0.00)	51.68 (0.00)	49.49 (0.00)	37.98 (0.00)
R-squared (within)	0.603	0.632	0.623	0.625	0.685

Note: Fixed effects regression. The number of observations is 8476 (326 regions, 26 years). * significant at 10%, ** significant at 5%, *** significant at 1%.

We find that our regional establishment size indicator is negatively related to diversity; this result corresponds with the spatial concentration literature. The relationship between region size and diversity takes the form of an inverted U-shape. The marginal effect turns out to be significantly negative for a few regions

(see figure EA1 in the appendix).⁵ Also in line with the findings on geographical concentration, entries are positively and exits are negatively related to regional diversity. Not surprisingly, coefficients for entries and exits become insignificant when controlling for the regional industry structure, since they directly influence diversity through the structure of the industry. Somewhat surprising, though still in line with the descriptive in Table A1 and Henderson (1997) and Dissart (2003), regional specialization is shown to a significant degree to be positively related to regional diversity. Using different definitions of this variable based on industry counts with a Location Quotient greater than 1.5 and greater than 2 does not change the general pattern reported here for specialization in manufacturing. Specialization in service industries becomes insignificant when controlling for the regional industry structure. Moreover, a count of specialized service industries based on a Location Quotient greater than 2 results in an insignificant coefficient. We also tested squared terms for industry specialization, which turned out to be insignificant.

5 The dynamics of diversity

5.1 Evolution of diversity in different types of regions

We shall first examine the evolution of diversity in different types of regions. Nearly all recent studies analyzing specialization or diversification at the regional level apply measures that compare diversity, or concentration, to the national industry shares, just as we did in the previous section. In our analysis of the dynamics of diversity, we explicitly wish to take national and regional trends in diversity into account, taking the dynamics of diversity at the national and regional levels into consideration. Furthermore, we differentiate between two basic types of diversity, namely diversity in incumbents founded before 1976 and total diversity based on all businesses. We distinguish between total and incumbents diversity in order to gain insight into how entries influence the dynamics of diversity at the regional and the

⁵ In fact, a significant negative marginal effect was only found for values of region size within the upper 5 percent of the distribution (based on column 5 in Table 2). The inverted U-shape that we find is caused by very agglomerated regions in the Ruhr-area, specialized in traditional industries and heavily affected by structural change, and agglomerated regions specialized in services.

national level. We calculate diversity at the national level for each year based on the Herfindahl-index:

$$National\ diversity_t = 1 - \sum_{s=1}^S \left(\frac{emp_{s,t}}{emp_t} \right)^2 \quad (1a)$$

where emp denotes the employment in sector s . We also calculate total and incumbents diversity for three different types of regions: agglomerations, moderately congested areas, and rural regions. To do so, we calculate averages across regions based on

$$Average\ regional\ diversity_t = \sum_{r=1}^R \left(1 - \sum_{s=1}^S \left(\frac{emp_{r,s,t}}{emp_{r,t}} \right)^2 \right) / R \quad (2a)$$

by simply calculating the diversity for each region r and then taking the average for the respective region type. Finally, we calculate a relative Herfindahl-index in the form

$$\begin{aligned} &Average\ relative\ regional\ diversity_t \\ &= \sum_{r=1}^R \left(\frac{1 - \sum_{s=1}^S \left(\frac{emp_{r,s,t}}{emp_{r,t}} \right)^2}{1 - \sum_{s=1}^S \left(\frac{emp_{s,t}}{emp_t} \right)^2} \right) / R \end{aligned} \quad (3a)$$

in order to express regional diversity relative to national diversity as an average over all regions.

We first begin with an analysis of the impact of entries on total diversity at the macro level using diversity measure (1a). At the regional level, the same type of analysis is done by calculating diversity measure (2a) for three different types of regions (agglomerations, moderately congested areas, and rural regions). In order to quantify the impact of entries on total regional diversity over time, we first calculate total diversity; secondly, we calculate diversity based on employment in incumbent businesses already in existence prior to 1976. The difference between these two diversity measures thus indicates the contribution of new businesses (those entering the market after 1976) to changes in diversity levels. Thus, in the

year 1975, the total diversity and the incumbents diversity is the same, as no entries have yet occurred. All results at the regional level are averages over the respective region type, meaning, for example, that total diversity in agglomerations gives the average diversity for all agglomerated regions. Figure 5-1 plots the results for agglomerations, moderately congested areas, and rural regions (based on diversity measure 2a), as well as diversity at the macro level based on aggregated data at the national level (diversity measure 1a).

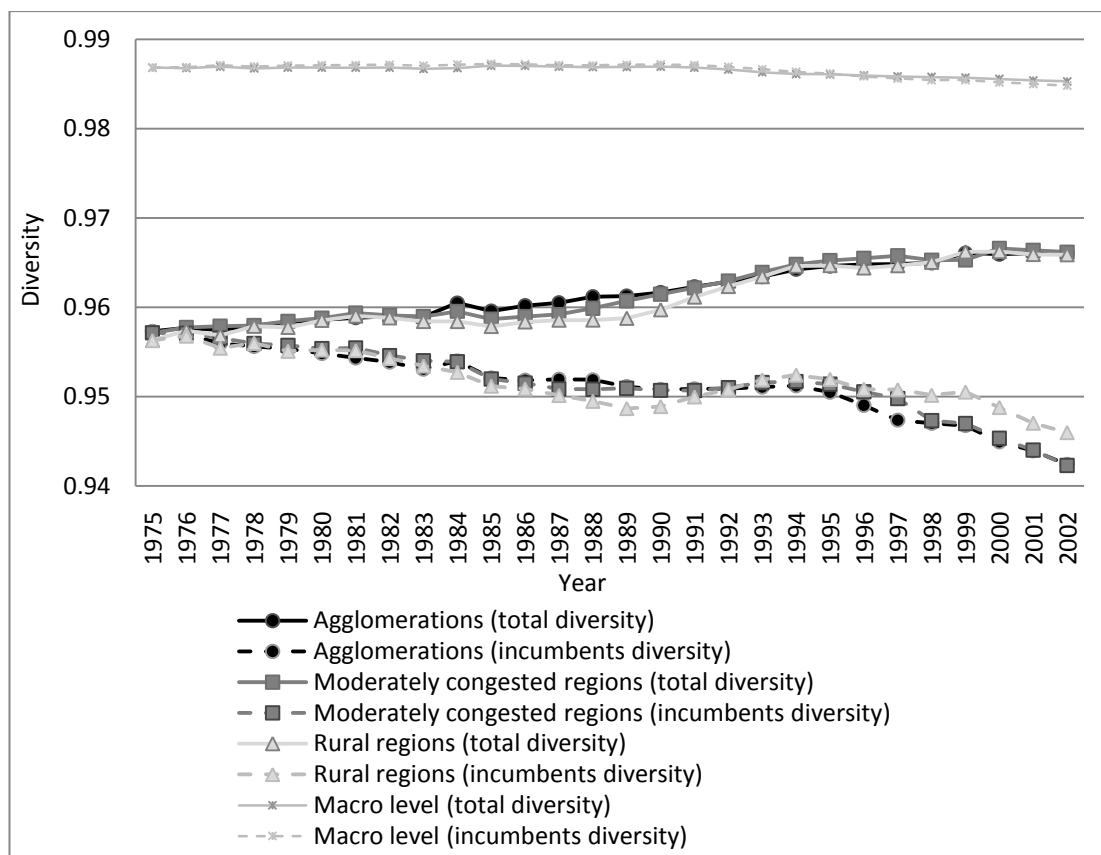


Figure 5-1: Development of total diversity and incumbents diversity for different types of regions and the national level

In Figure 5-1, we observe a very stable total national diversity and incumbents diversity up until 1991 and thereafter, a very modest decrease in diversity. There is no clear difference in the time pattern of total and incumbents diversity, so that entries are concluded not to increase or decrease diversity at the macro level. The observation that total diversity and diversity in incumbents reflect almost the same development over time at the national level is somewhat

surprising due to the fact that in 2002, the employees working in incumbent businesses founded prior to 1975 account for only 25 % of the total employment.

At the regional level, we observe a relatively strong increase in total diversity compared to the macro pattern. At the same time, industry diversity of employment in incumbent businesses is decreasing, suggesting that market selection acts as a specializing force. This pattern can be observed for the average diversity of all three region types and implies that entries are only important for changes in diversity at the regional level,⁶ but not at the aggregate macro level. In order to test whether, and if so, at what point in time, total diversity and incumbents diversity are statistically significant, we conduct a simple t-test over the total sample of regions. We find a significant difference already in the year 1976.

We also calculate average values of regional relative diversity for the three region types based on relative diversity measure (3a), which are reported in Figure 5-2. Basically, the same pattern is observed; total diversity increases while diversity in the incumbent businesses does not. In contrast to Figure 5-1, diversity is also seen to be largest in agglomerations and smallest in rural regions, which is in line with the estimation results of Table 4-2. However, the gap between agglomerations, moderately congested areas, and rural regions becomes smaller over time. The pattern of increasing regional diversity accompanied by decreasing or rather stable diversity of incumbents corresponds with the findings of Dumais et al. (2002), who suggest that entries reduce geographic concentration, while closures maintain concentration.

⁶ Based on pooled data over all years, total diversity based on diversity measure (2) does not differ between agglomerations, moderately congested regions, and rural areas. However, the variation within different types of regions is quite large.

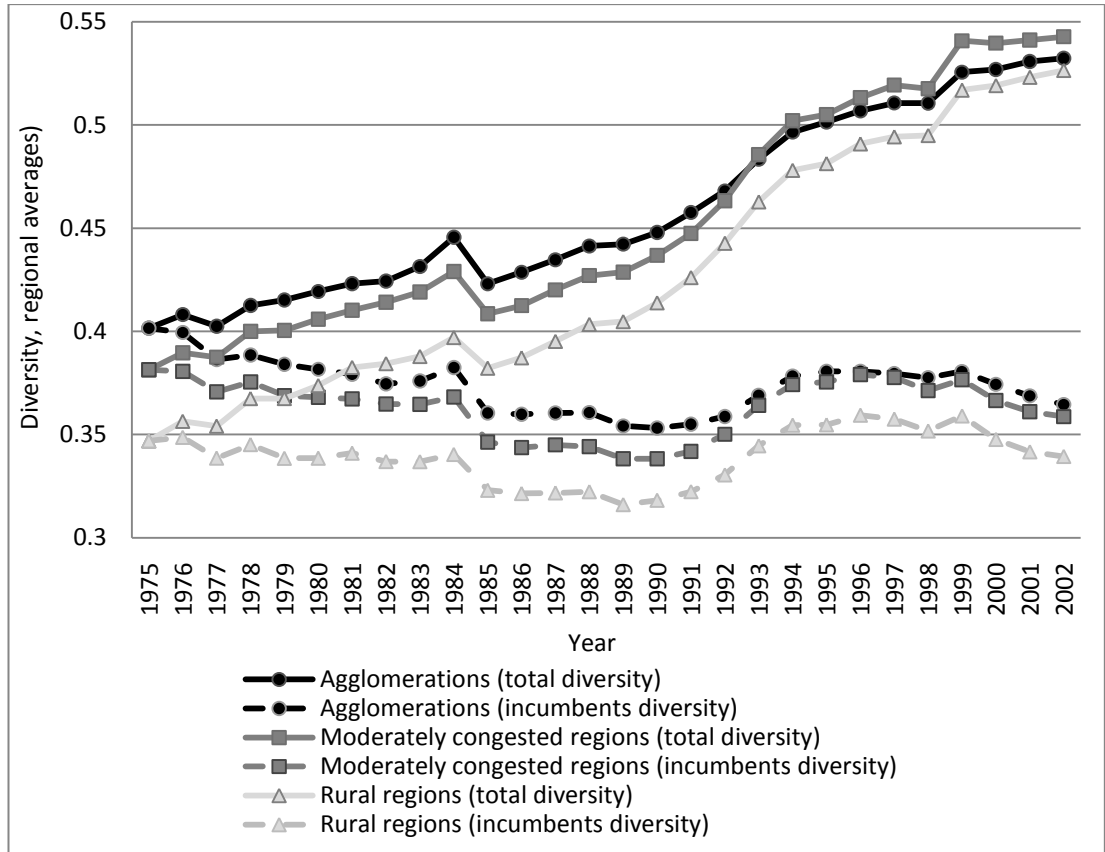


Figure 5-2: Development of relative total diversity and incumbents diversity for different types of regions (average values of relative diversity for different region types)

5.2 The Evolution of Diversity in Entry Cohorts

We now turn to the development of diversity in entry cohorts over time. The data allows us to track the employment development of the entry cohorts over time. Thus, it is possible to determine whether 5, 10, or 20 years of competition result in a more diverse or concentrated industry structure. In order to analyze the diversity of entries, we again begin with certain national patterns of changes in diversity. To analyze macro-patterns of diversity in entries, we first calculate, analogous to diversity measure (1a), the Herfindahl-index for each entry cohort c for the year of entry t and all succeeding years based on aggregated industry employment data at the national level

$$Nationale\ diversity_t^{Cohort_c} = 1 - \sum_{s=1}^S \left(\frac{emp_{s,t}^{Cohort_c}}{emp_t^{Cohort_c}} \right)^2 \quad (1b)$$

where emp denotes the employment in sector s in the cohort c . In order to calculate diversity, we use employment data at the three-digit industry level. Then, we compare the macro-pattern with the aggregated regional-patterns of diversity, calculating diversity in entries as

$$\begin{aligned} & \text{Average regional diversity}_t^{Cohort_c} \\ &= \sum_{r=1}^R \left(1 - \sum_{s=1}^S \left(\frac{emp_{r,s,t}^{Cohort_c}}{emp_{r,t}^{Cohort_c}} \right)^2 \right) / R \end{aligned} \quad (2b)$$

which gives us the diversity in entries (calculated separately for each region r) as an average over all regions. Since 27 cohorts are now being analyzed, different regional types are not distinguished, so as to allow a clear arrangement in the figures.

Finally, we calculate a relative Herfindahl-index in the form

$$\begin{aligned} & \text{Average relative reg. div.}_t^{Cohort_c} \\ &= \sum_{r=1}^R \left(\frac{1 - \sum_{s=1}^S \left(\frac{emp_{r,s,t}^{Cohort_c}}{emp_{r,t}^{Cohort_c}} \right)^2}{1 - \sum_{s=1}^S \left(\frac{emp_{s,t}^{Cohort_c}}{emp_t^{Cohort_c}} \right)^2} \right) / R \end{aligned} \quad (3b)$$

in order to express the level of regional diversity relative to the national diversity as an average over all regions.

Figure 2 plots the diversity of entries over time based on diversity measure (1b) at the macro level, figure 3 shows the results based on measure (2b) presenting averages over all regions, and figure 4 reports regional averages for the relative diversity measure (3b) accordingly. All figures report regional averages of diversity levels for the age of the respective entry cohort. For purposes of comparison, total diversity and incumbents diversity are also included, where the number of years is equal to the 1975 to 2002 time period.

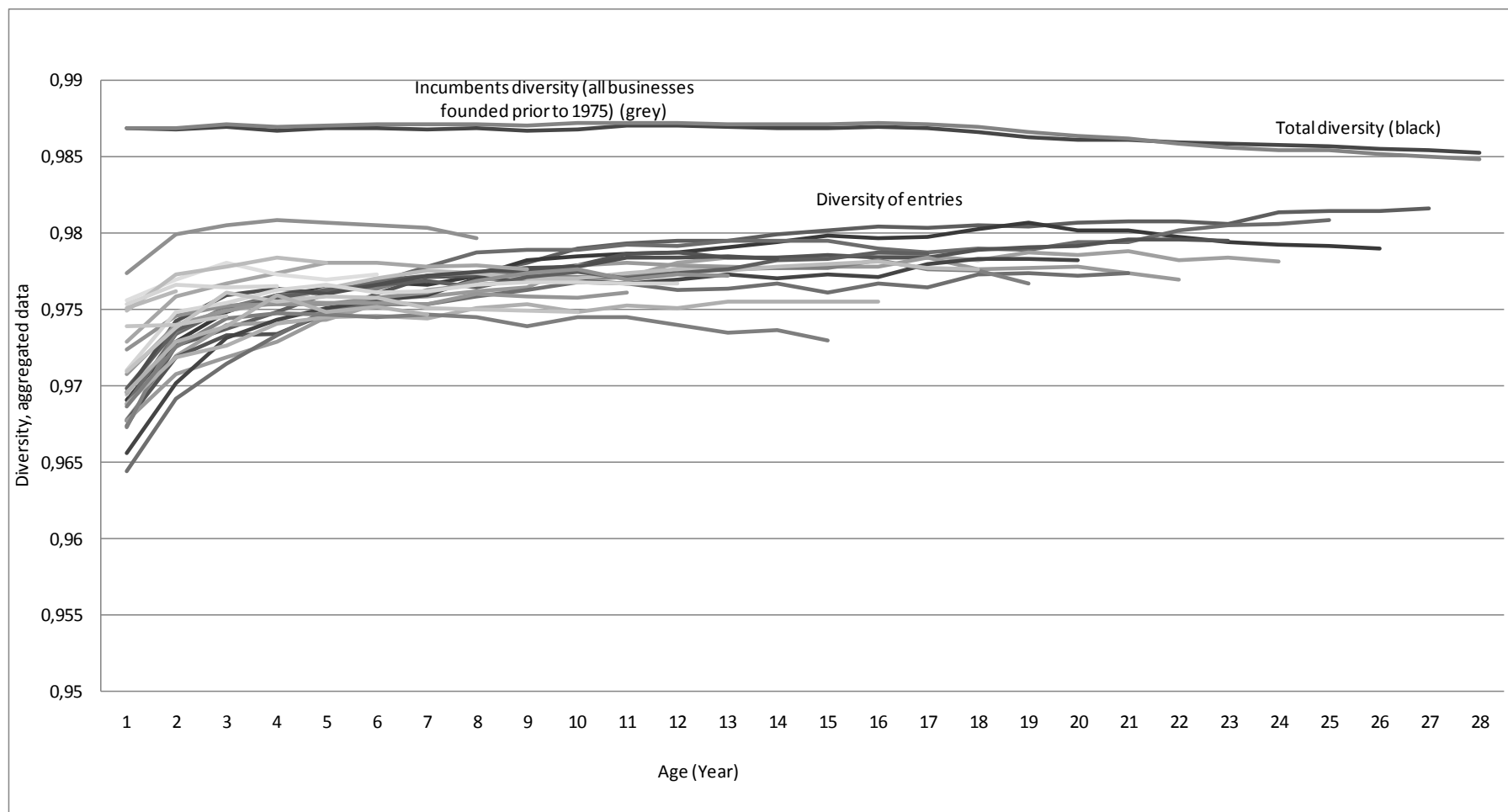


Figure 5-3: Development of total diversity, diversity in entries, and diversity in incumbents (country level)

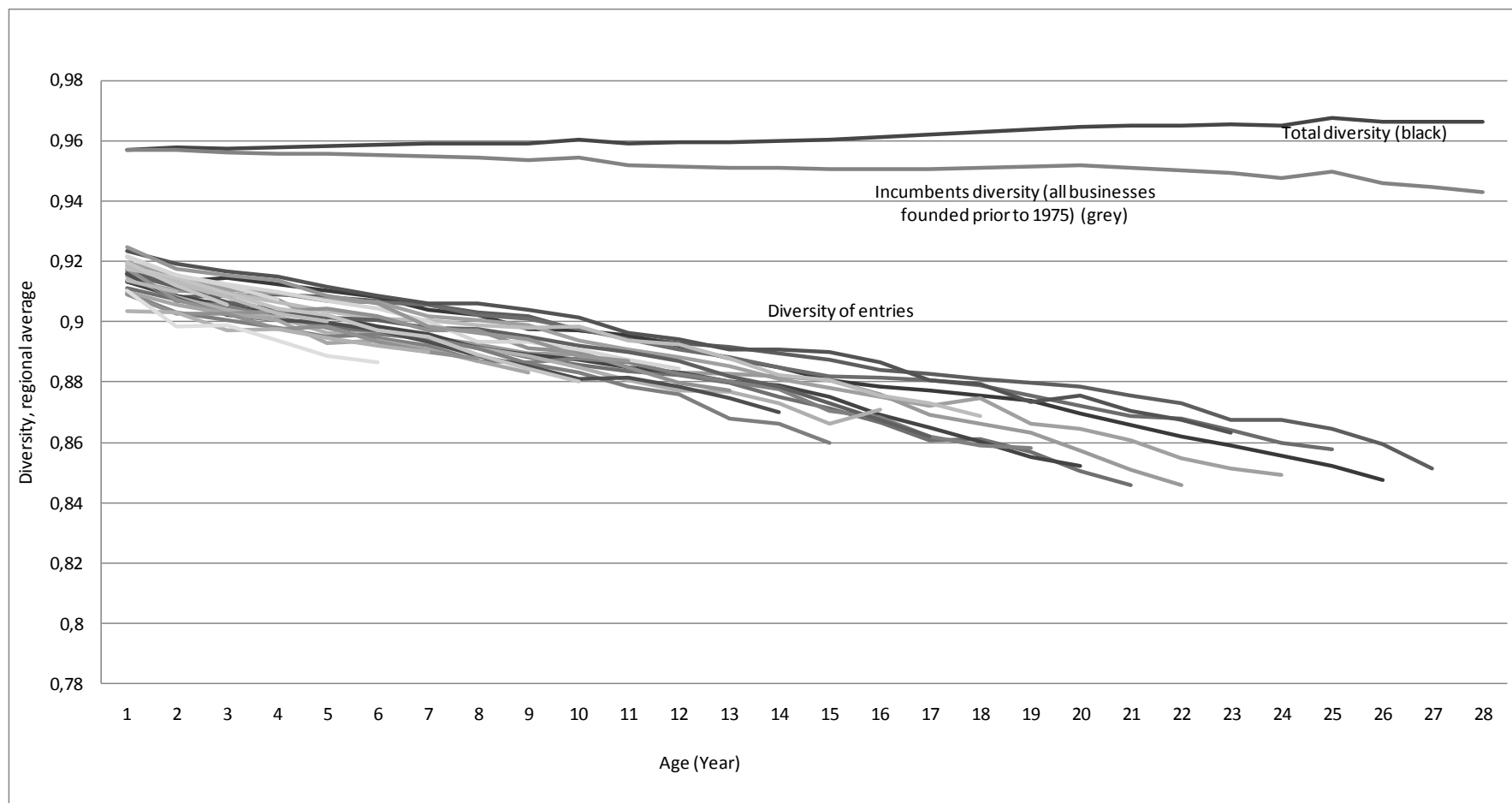


Figure 5-4: Development of total diversity, diversity in entries, and diversity in incumbents (regional diversity calculated as an average over all regions)

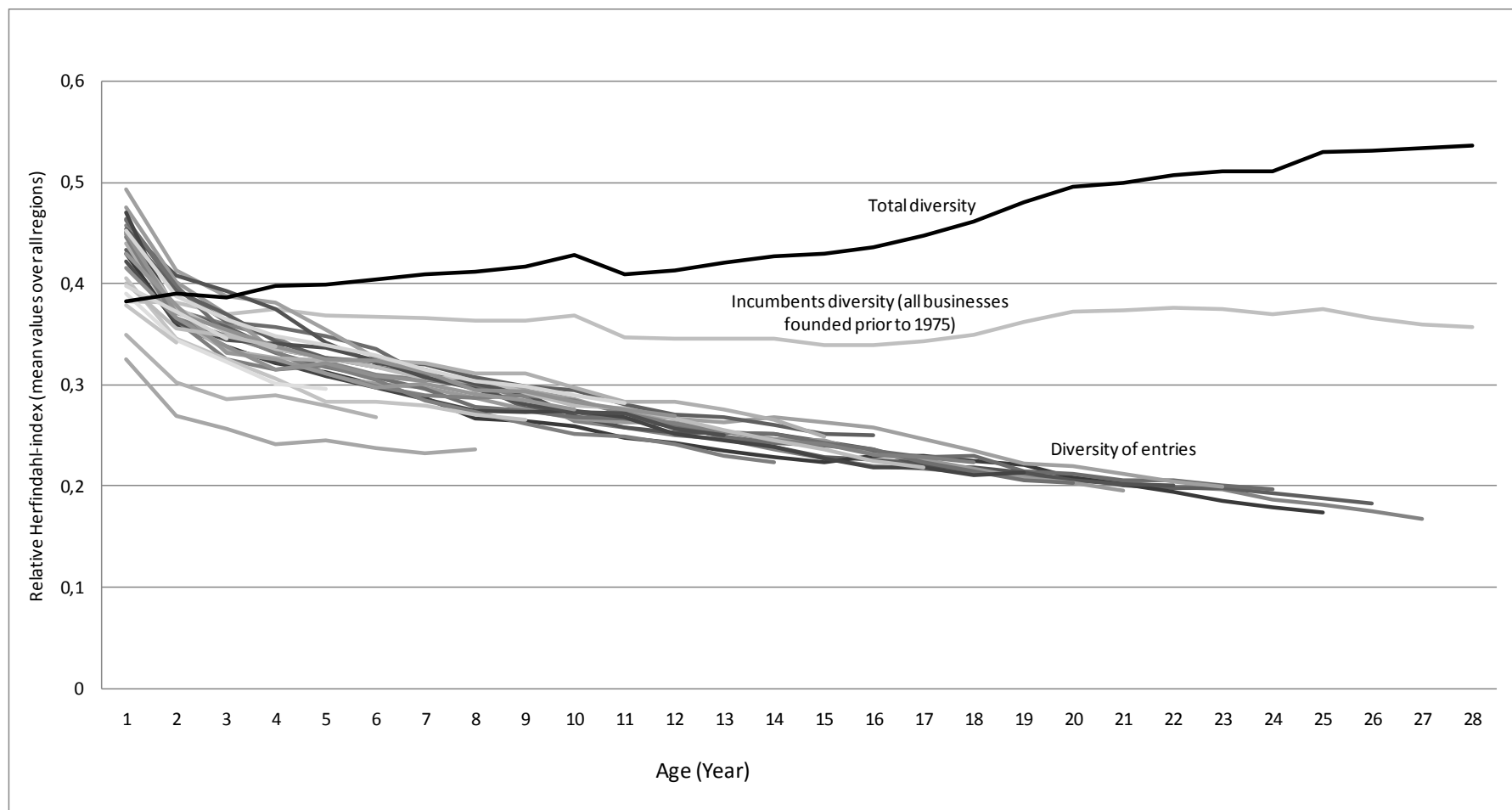


Figure 5-5: Development of total diversity, diversity in entries, and diversity in incumbents (relative diversity calculated as an average over all regions)

In Figure 6-3 (diversity at the national level), diversity in entry cohorts for most cohorts is shown to increase during the first five years. Thereafter, for most cohorts, diversity steadily increases at a somewhat lower level than during the first couple of years, while some cohorts increase initially and then, no longer increase or even show a slight decrease in diversity. This macro observation suggests that market selection favors a diverse industry structure in entries.

At the regional level in Figure 6-4 (average regional diversity), a different pattern emerges. Total diversity slowly increases over time, while incumbents diversity decreases (as shown in Figure 5-1 for different types of regions).⁷ For the entry cohorts, a steady decrease in diversity over time is observed. Thus, for the mean diversity at the regional level, market selection decreases the industry diversity in entries. This decreasing diversity can be noted in different types of regions and is thus not solely driven by certain specific regions. This pattern is also not caused by shifts towards service industries that occurred during this time period and holds for manufacturing industries as well.⁸ Another difference from the national level is the rather linear decrease in diversity over time, while the macro pattern suggests stronger changes in entry diversity during the first years. Figure 5-5 reports results for the relative HHI-index as a mean over all regions. As in

Figure 5-4 6-4, diversity of entries decreases. Since the gap in total and incumbents diversity for regions suggests entries as the main contributor to the increase in regional diversity, we should note that comparisons of the diversity levels among entries, incumbents, and total diversity are inadequate in Figure 6-4 and 6-5. This inadequacy is due to the fact that the internal diversity of an entry cohort does not reveal how total diversity is influenced. It might well be, for example, that a region has only limited diversity in the entries, but that they

⁷ The increase in total diversity is in line with the results of Drucker (2009), who notes a decreasing regional concentration for US-manufacturing industries since at least the early 1970s, and Südekum (2006), who finds some evidence for a decrease in specialization in German regions since 1993.

⁸ In Figure A2 in the appendix, we report average development in entry cohorts at the regional level for different region types (agglomerations, moderately congested areas, and rural regions). The pattern found for the average regions can also be found for the averages of region-types. Also, the level-differences between region-types are in line with our expectations: agglomerations have the highest levels, rural regions the lowest levels of average diversity of entries. The decrease over time is approximately the same for all three types of regions. Figure A3 reports results for manufacturing industries.

strongly influence total diversity, such as if an successful entry mainly occurs in underrepresented industries. Therefore, it is important to note that although selection decreases diversity in entries in the region, total diversity increases at the regional level. Two further aspects in this regard are noteworthy:

- Entries have a positive impact on total regional diversification of the industry structure (stable/decreasing diversity of incumbents but increasing total diversity), while total diversity at the macro level remains rather stable,
- market selection decreases an entry cohorts' diversity over time in the region (*regional specialization*) but increases an entry cohorts' diversity at the macro level (*macro diversification*).

Particularly the difference in the development of industry diversity in the entry cohorts at the macro and the regional level demands an economic explanation. Thus, why does market selection increase the diversity in entries at the macro level, while it decreases diversity in entries at the regional level? The answer must include a process in which region specific characteristics drive selection in some way, resulting in decreasing diversity in entry cohorts for the region and an increasing diversity of entries at the national level. Such a regional decrease in entry-cohort-diversity might be the outcome of the disproportionately large growth of entries in some industries and/or a relatively prominent decline in other industries. At the same time, the specialization within the entries in a region leads to diversification at the macro level. Such a process of market selection demands three things. Firstly, regions need to have certain characteristics that tend to support selection in entry cohorts in favor of an industry or a set of industries. Secondly, these region specific characteristics must be distinct enough among regions to increase industry-diversity at the macro level. Thirdly, in order to allow for an increase in total regional diversity, selection within a region must favor industries that are underrepresented in the initial industry structure.

Evidence for the first condition (regional selection within entries towards an industry/set of industries) is reported in Figure 5-6. This figure displays Kernel-density plots for the regional distribution of relative HHI-diversity of the entry cohort 1976 for different years. The observable pattern holds for other entry cohorts as well. The regional distribution of relative diversity of entry-cohorts

exhibits a decrease in the regional mean diversity over time, as well as a strong decrease in the variance between regions. These decreases clearly indicate that entries specialize within regions.

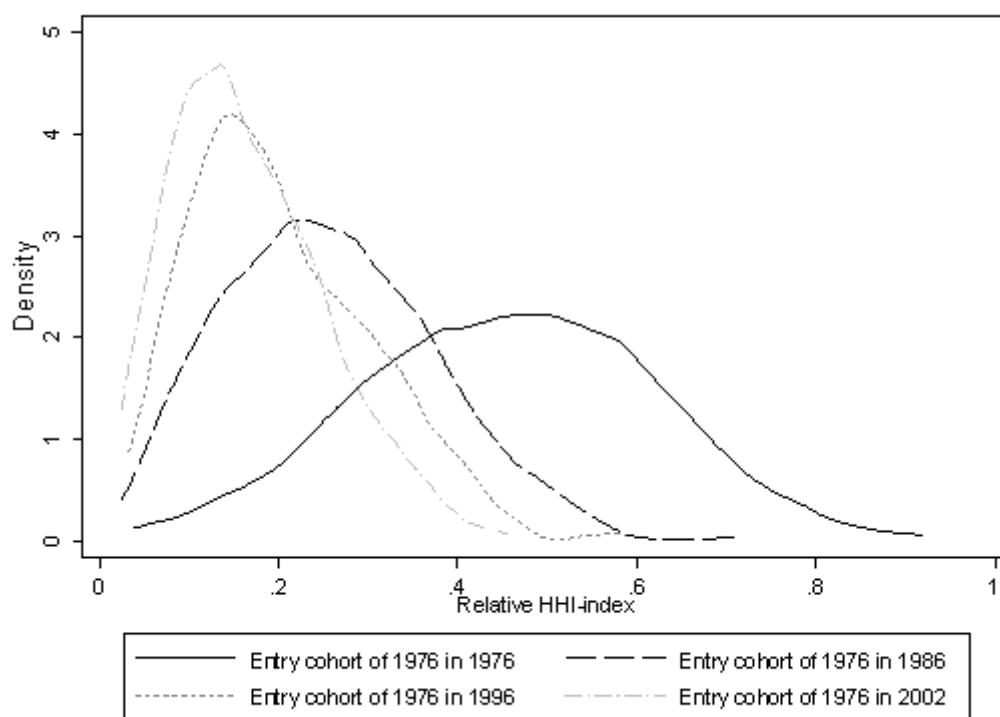


Figure 5-6: Kernel-density plots of the regional distribution of the relative HHI-index, entry cohort of 1976

The second condition is the need for different specialization across regions in entry cohorts at the regional level, meaning that the industry structure of entries can be assumed to be more similar among regions at the time of entry and to become less similar over time. Accordingly, market selection should reduce the regional similarity of the industry structure of entries, since different regions specialize in certain fields.

To demonstrate this, pair-wise correlations for all 326 regions, based on industry-employment shares of the entry cohort 1976, are calculated. Table 5-1 is an excerpt of the entire correlation matrix, which consists of 52,957 single correlations. The correlation between two regions indicates the similarity of the industry structure of the entry cohort 1976. This is done for the year 1976 (time of entry) and then repeated for the year 1986 (ten years later).

Table 5-1: Extract of (industry structure) correlations between regions for the entry cohort 1976 in the year 1976

	Region 1	Region 2	Region 3	Region 4	...	Region 326
Region 1	–					
Region 2	0.6898	–				
Region 3	0.599	0.4458	–			
Region 4	0.638	0.3707	0.6409	–		
...	–	
Region 326	0.7048	0.3411	0.5587	0.7271	...	–

Note: Correlations based on industry employment shares of the entry cohort 1976 in the year 1976.

The average correlation of industry employment in the entry cohort 1976 at the time of entry is 0.5678. After ten years, the industry structure of the entry cohort is less similar across regions. The average correlation coefficient in the year 1986 decreases to 0.3791.

Also, at a more aggregate level, a pattern of decreasing similarity of the industry structure of entry cohorts across regions can be observed. We aggregate employment in the entry cohorts over two different types of regions: agglomerations and moderately congested regions. Then, based on employment shares at the industry level, we calculate correlations for each entry cohort between agglomerations and moderately congested regions for the respective years. The respective results are reported in Figure 5-7.

Supporting our argumentation, we observe that the regional similarity of the industry structure of entries is relatively high at the time of entry and then decreases over time. Given the rather similar industry structure at the time of entry and the following process of specialization due to market selection, many entries might be perceived not to “fit” the regional environment. Accordingly, policy might be tempted to provide incentives towards a more specialized industry structure that better fits the region at the time of entry. However, such an attempt is not advisable because, on average, market selection does not favor entries in industries in which the region already has an economic focus.

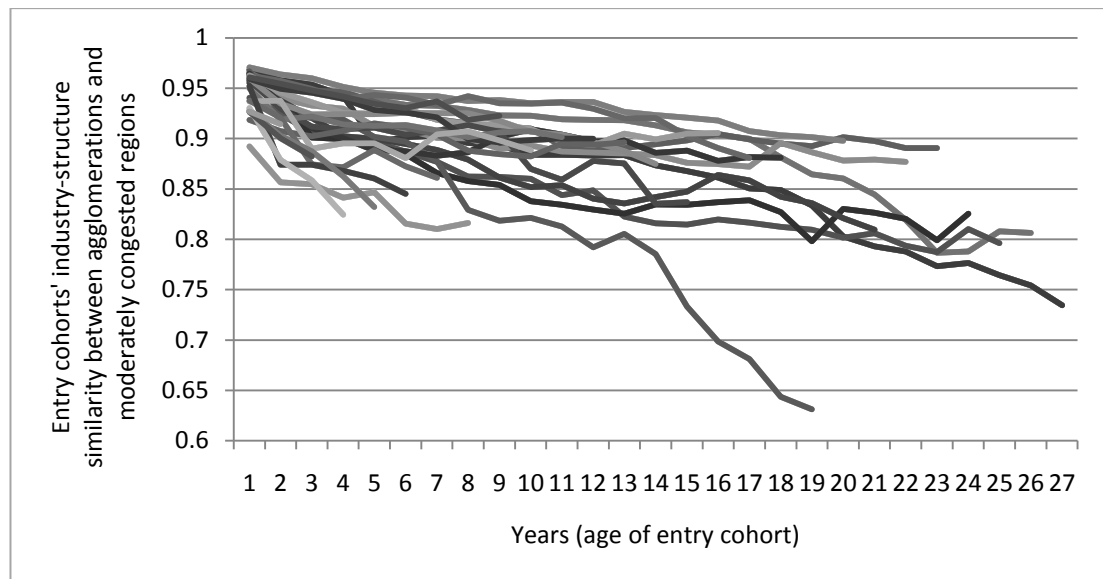


Figure 5-7: Similarity of the industry-employment shares in entries between agglomerations and moderately congested regions (for different years of age).

In order to show that, we simply correlate the industry shares of entries with the existing industry structure in a region.⁹ Figure 5-8 reports the average regional correlation between the industry shares in the entry cohort of 1976 and regional industry structure (regional industry shares are calculated based on total employment minus employment of the entry cohort of 1976). Furthermore, we incorporate the average regional correlation between the entry cohort of 1976 and the employment in businesses founded prior to 1976. Over time, the correlation between the industry structure of the entry cohort of 1976 and the regional industry structure is decreasing; this observation generally holds true for other cohorts as well. Therefore, market selection at the regional level does not seem to favor industries that already have a strong footing in the region. This pattern also fits with the observation made in

Figure 5-4 and Figure 5-5, in which total diversity in a region increases, while diversity of incumbent businesses remains relatively stable. As such, we conclude that entries increase total regional diversity by means of a selection towards industries relatively underrepresented or new to the region.

⁹ While we use correlations across regions to show that entries are rather similar among different regions at the time of entry and become less similar over time, we now correlate the industry structure of an entry cohort with the existing industry structure in the region. Thus, Figure 11 compares similarities among regions, while Figure 12 reports average correlations within regions.

Our results suggest that ongoing specialization in entry cohorts cannot be sufficiently predicted by the initial regional industry structure itself. This discovery makes it likely that much of the diversity decreasing process at the regional level occurs in a sphere wherein market forces still decide which regions specialize in respective fields.

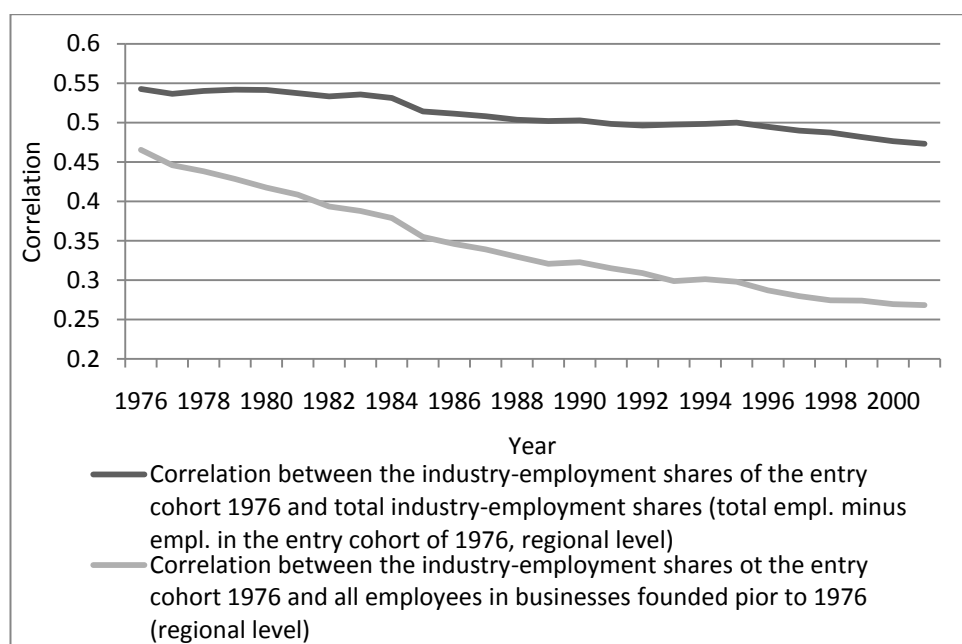


Figure 5-8: Average regional correlation between the industry shares of the entry cohort 1976 and (i) the regional industry structure, (ii) the regional industry structure based only on incumbents' employment

A simplified illustration that helps to explain how market selection can result in decreasing diversity in entries at the regional level, while macro-diversity increases is shown in Figure 5-9. The upper half of Figure 5-9 presents the idealized employment distribution of new businesses in two regions at the time of entry, while the lower half relates the employment distribution in these businesses after some years of selection. In $t=0$, the employment distribution over industries at the regional level is flatter, resulting in relatively high levels of diversity. Since the distributions are relatively close to each other, the resulting distribution at the macro level shows relatively low diversity. Introducing a distribution at the regional level leading to less diversity due to specialization within the region shows that diversity increases at the national level, as long as regional distributions do not converge. This effect increases when specialization in a region results in larger dispersion of the single distributions at the regional level. It should be noted that it

is not necessary that all regions have less diversity in the entry cohorts; it is already sufficient if some of them have decreasing diversity or specialization that induces a distributional dispersion. Such a process also implies the industry structure in the entry cohorts as more similar between region 1 and region 2 at the time of entry than it is after a certain amount of time under market selection has passed.

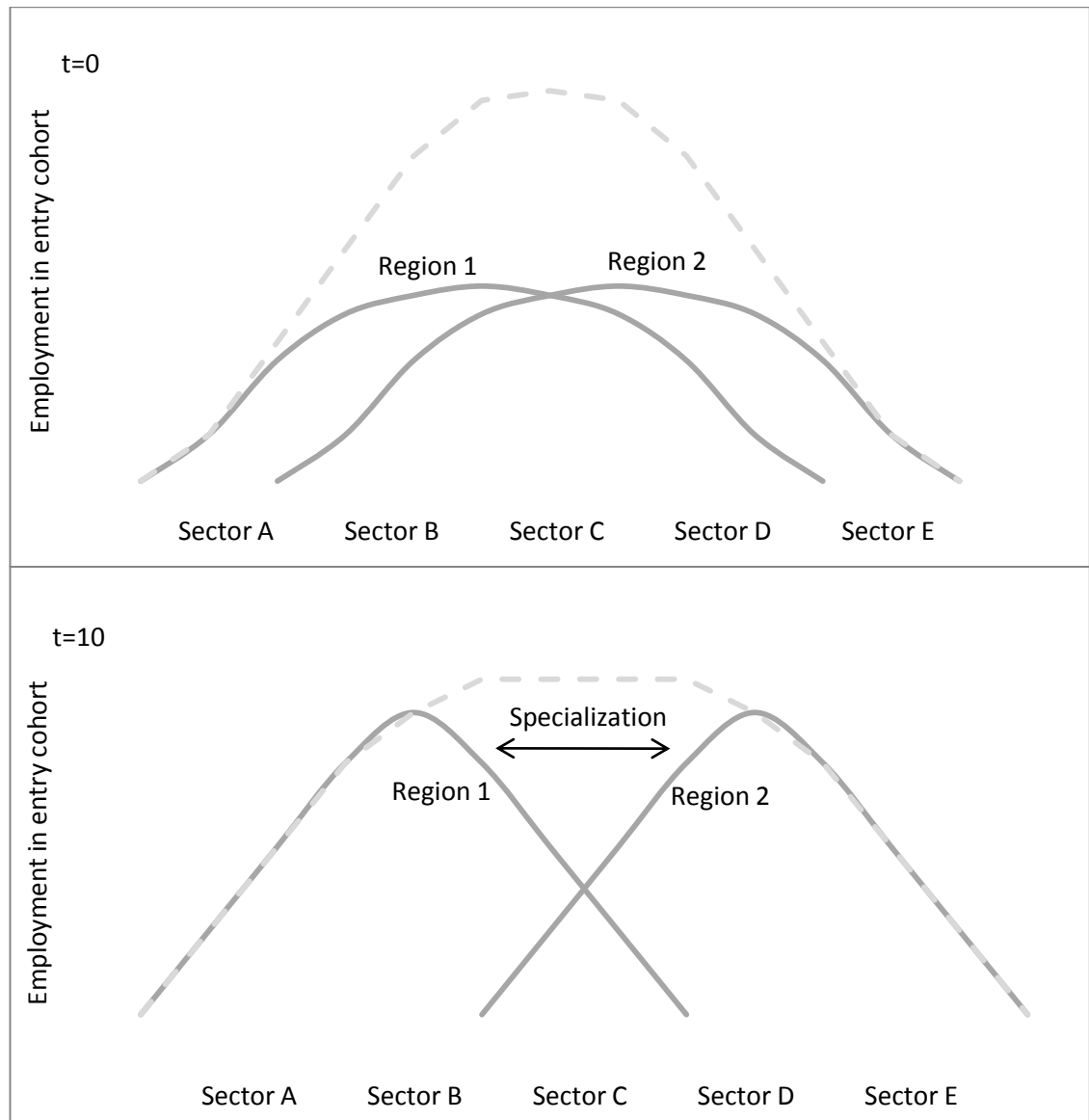


Figure 5-9: Simplified diagram of changes in the industry employment distribution of entries at the regional and macro-level

6 Summary and Conclusions

This paper analyzes the dynamics of diversity with a special focus on the role of entries. At the macro level, we find that market selection increases diversity in entries, while the opposite is true at the level of regions. This pattern can be explained by a process of specialization at the regional level:

- start-ups enter the market with a relatively high level of industry diversity within regions; the industry structure in the entry cohort is rather similar among different types of regions at the time of entry,
- market selection decreases diversity in entries within a region (*industry specialization within regions*); at the same time, market selection decreases the similarity in the industry structure of the entry cohort among different region types (*industry specialization between regions*).

Over time, market selection decreases industry diversity of entries such that after 20 years, approximately half of the initial diversity is gone. Regional diversity in incumbent businesses is also found to decrease over time, while the total industry diversity increased over the last three decades in West-German regions. This suggests that entries play an active role in the diversification of the local industry structure, which can promote innovation, growth, and regional stability. In fact, empirical evidence reveals market selection within a region to result in a decreased similarity between the industry structure of entries and the region's overall industry structure as time goes by. These results agree with the literature on geographic concentration that finds a de-concentrating role of entries, as described by Dumais et al. (2002). Regional diversity increases due to a selection process that decreases diversity in entries within a region but in such a way as to decrease the similarity between the industry structure of entries and incumbents over time. Thus, selection in a region favors entries that are less similar to incumbent businesses.

A summary of the basic findings of diversity evolution includes the following: (I) total macro diversity is rather stable over time; at most, a slight decrease in macro diversity can be observed. (II) Total regional diversity increases over time; only small differences exist among agglomerations, moderately congested areas, and rural regions. (III) In the entry cohorts, we can observe an increasing diversity in

entries at the macro level, meaning that market selection favors a diverse industry structure of entries at the aggregate level. (IV) At the regional level, however, market selection decreases diversity in entries. This pattern can be termed “within (regional) specialization of entry cohorts”. (V) There is no conflict in (III) and (IV), if the employment distribution at the time of entry is rather similar among regions (entries in different regions focus on similar industries), but over time market selection decreases the similarity in the industry structure of entries due to regional specializations in different industries. This pattern can be labeled “between (regional) specializations of entry cohorts”. (VI) Finally, observation (II) can easily be explained by showing that market selection increases total regional diversity by favoring relatively underrepresented industries in the new entries.

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Table A1: Ranking of regional diversification, Number of specialized industries in parenthesis (manufacturing / services)

	1975	1985	1995	2002
1	Ortenaukreis (6/2)	Ortenaukreis (8/1)	Ravensburg (9/2)	Ravensburg (8/2)
2	KS Wuppertal (6/3)	KS Wuppertal (6/2)	Ortenaukreis (7/2)	Karlsruhe (8/1)
3	Bergstraße (7/1)	Ravensburg (9/3)	Main-Kinzig-Kreis (8/1)	Emsland (11/1)
4	Ravensburg (8/3)	Bergstraße (6/4)	Emsland (10/1)	Schwandorf (8/0)
5	Main-Kinzig-Kreis (8/1)	Northeim (8/2)	KS Wuppertal(6/3)	Minden-Luebbecke (8/2)
6	Rems-Murr-Kreis (8/0)	Wetteraukreis (4/5)	Northeim (9/1)	Main-Kinzig-Kreis (5/2)
7	Pinneberg (4/1)	Hochsauerlandkreis (7/2)	Karlsruhe (7/1)	Hochsauerlandkreis (8/2)
8	Alb-Donau-Kreis (9/0)	Alb-Donau-Kreis (8/0)	Konstanz (4/3)	Ortenaukreis (8/3)
9	Wetteraukreis (4/4)	Main-Kinzig-Kreis (8/0)	Minden-Luebbecke (7/2)	Rems-Murr-Kreis (7/0)
10	Region Hannover (3/6)	Emsland (7/1)	Schwandorf (9/1)	Konstanz (6/3)
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317	KS Ingolstadt (2/0)	KS Erlangen (1/3)	Kassel (2/1)	Kassel (1/1)
318	KS Erlangen (1/2)	Groß-Gerau (3/1)	Germersheim (4/1)	KS Erlangen (2/3)
319	Groß-Gerau (5/0)	Pirmasens /Südwestpfalz (3/0)	Altoetting (2/0)	Altoetting (2/0)
320	Dingolfing-Landau (5/0)	KS Schweinfurt (2/0)	KS Ingolstadt (2/1)	Germersheim (5/0)
321	Altoetting (2/0)	KS Ingolstadt (3/0)	KS Erlangen (1/3)	KS Leverkusen (2/1)
322	KS Schweinfurt (2/0)	Altoetting (2/0)	KS Emden (1/1)	KS Emden (1/2)
323	KS Leverkusen (3/0)	KS Leverkusen (2/0)	KS Leverkusen (2/0)	KS Ingolstadt (2/0)
324	KS Ludwigshafen am Rhein (2/0)	KS Ludwigshafen am Rhein (1/0)	KS Ludwigshafen am Rhein (1/0)	KS Ludwigshafen am Rhein (1/0)
325	Pirmasens/Südwestpfalz(3/0)	Dingolfing-Landau (4/0)	Dingolfing-Landau (2/0)	Dingolfing-Landau (3/0)
326	KS Wolfsburg (1/0)	KS Wolfsburg (1/0)	KS Wolfsburg (1/0)	KS Wolfsburg (1/0)

Note: The number of specialized industries is a tally of industries in which a region has a Location Quotient larger than 1. The Location Quotient measures the regional share of employment in an industry relative to the industry employment share at the national level. Industry specialization is based on 28 aggregated industries.

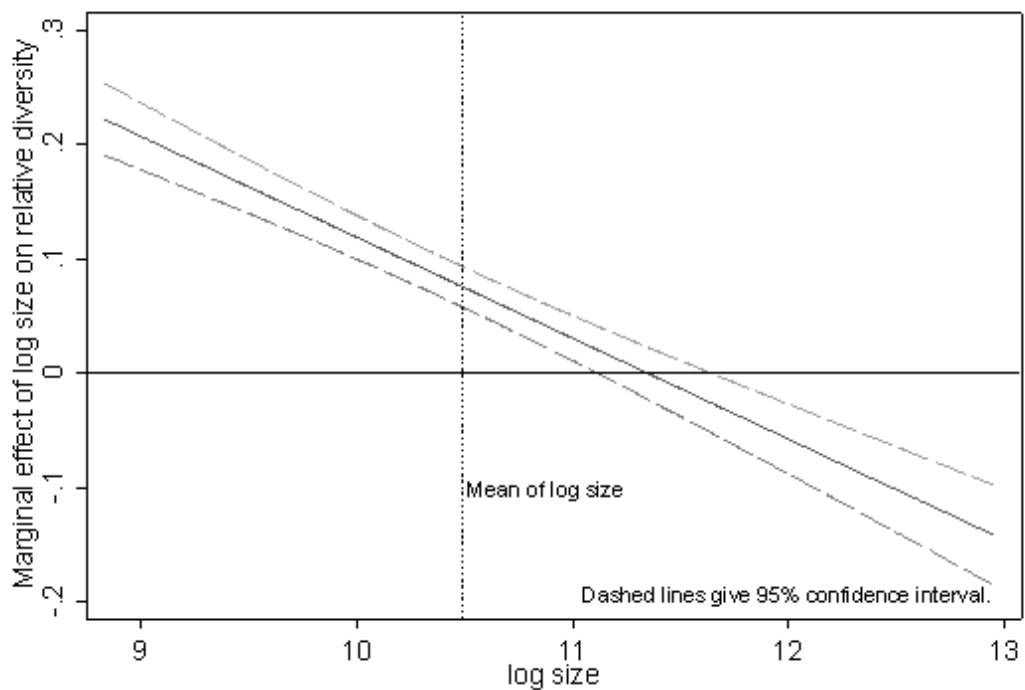


Figure A1: Marginal effect of region size on relative regional diversity for different levels of region size

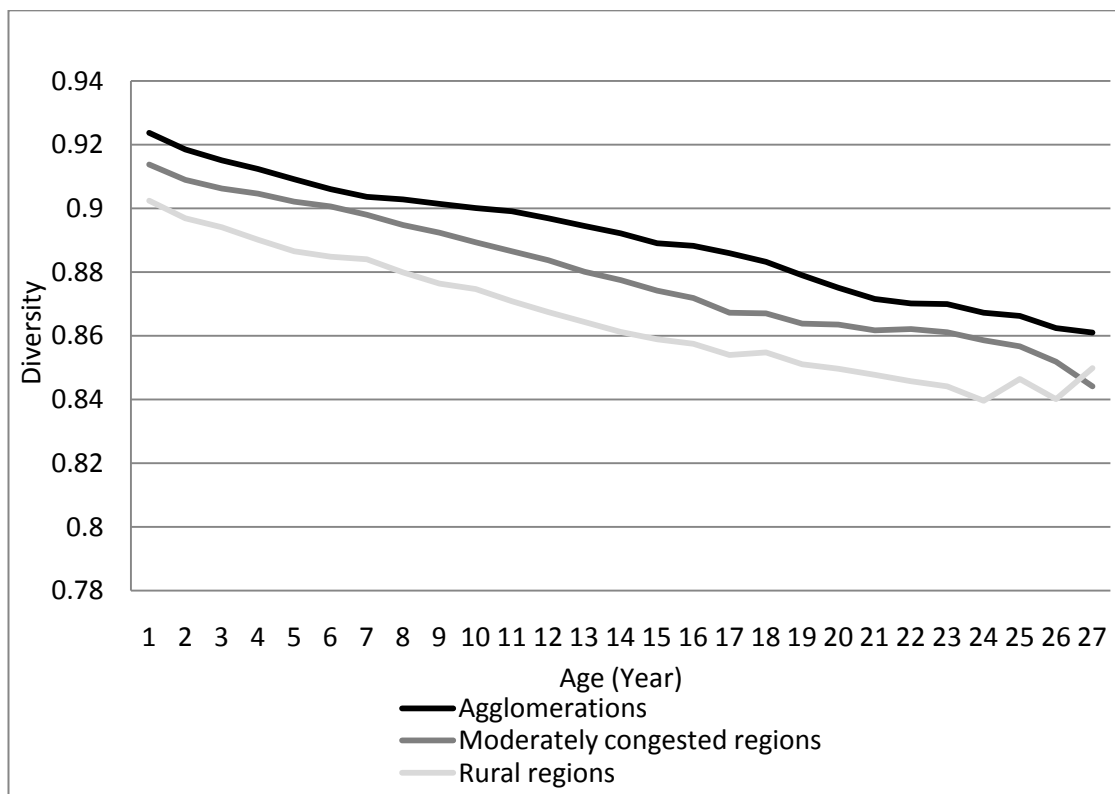


Figure A2: Development of diversity in the entry cohort 1976 (regional data calculated as an average over different types of regions)

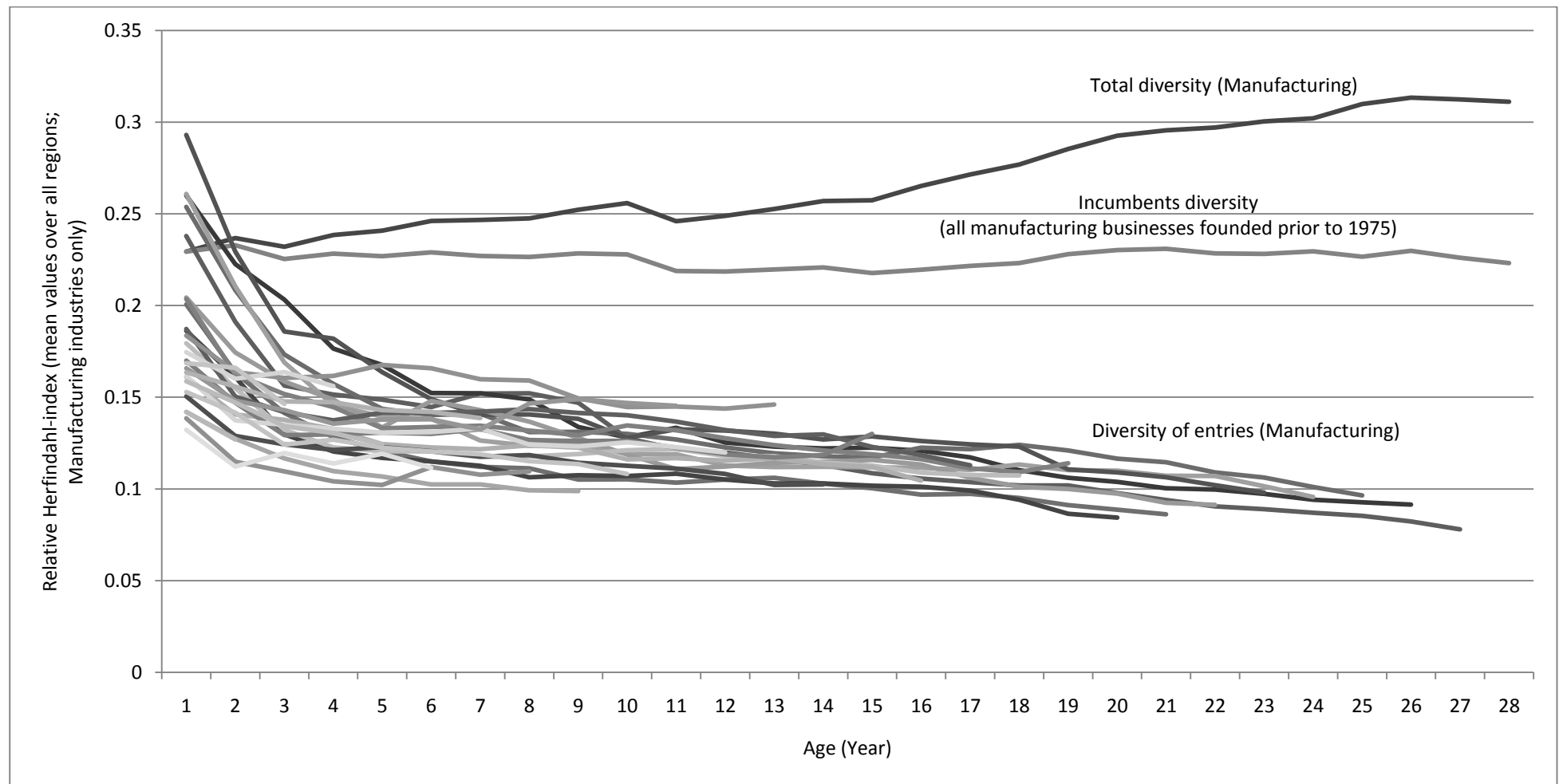


Figure A3: Development of relative regional diversity, manufacturing industries (regional data calculated as an average over all regions)