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Working Paper

The persistence of regional entrepreneurship: Are all types of self-employment equally important?

Jena Economic Research Papers, No. 2015-008

Provided in Cooperation with:

Friedrich Schiller University Jena, Faculty of Economics and Business Administration

Suggested Citation: Fritsch, Michael; Wyrwich, Michael (2015) : The persistence of regional entrepreneurship: Are all types of self-employment equally important?, Jena Economic Research Papers, No. 2015-008, Friedrich Schiller University Jena, Jena

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JENA ECONOMIC RESEARCH PAPERS



2015 – 008

The Persistence of Regional Entrepreneurship – Are all types of Self-Employment Equally Important?

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www.jenecon.de

ISSN 1864-7057

The JENA ECONOMIC RESEARCH PAPERS is a joint publication of the Friedrich Schiller University Jena, Germany. For editorial correspondence please contact markus.pasche@uni-jena.de.

Impressum:

Friedrich Schiller University Jena
Carl-Zeiss-Str. 3
D-07743 Jena
www.uni-jena.de

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Chapter for Elizabeth Mack and Haifeng Qian (eds.): *The Geography of Entrepreneurship*. Abingdon: Routledge.

June 2015

Abstract

We explore the role of different types of self-employment for a persistence of the regional level of entrepreneurship over time. Our analysis for West German regions shows relatively strong effects for the historical self-employment rate in the non-agricultural sector, particularly in knowledge-intensive industries on current levels of new business formation. While self-employment by males shows a statistically significant relationship, the self-employment rate of females remains statistically insignificant. Also, no statistically significant effect can be found for the share of homeworkers that can be regarded a rather weak form of entrepreneurship.

Keywords: Entrepreneurship, self-employment, new business formation, entrepreneurship culture, persistence

JEL classification: L26, R11, O11

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1. Introduction¹

Empirical research on the persistence of regional entrepreneurship has begun only recently.² These analyses suggest that spatial differences in the level of entrepreneurship are rather robust and long-lasting. In a recent assessment of this phenomenon in Germany (Fritsch & Wyrwich, 2014), we could show that there is persistence over the period from 1925 to 2005 despite several economic and political shocks such as the devastating World War II, occupation by the Allied Forces and reconstruction of the country. Moreover, the Eastern part of Germany was under a socialist regime for forty years that made intensive attempts to extinguish private sector economic initiative; after the socialist period, East Germany was subject to a shock transformation into a market economic system (see Fritsch et al., 2014, for a detailed analysis of the East German case). Since these patterns can hardly be explained by a persistence of the determinants of entrepreneurship, they may be regarded to indicate different regional traditions or “cultures” of entrepreneurship.

In this contribution we investigate the role of different kinds of historical self-employment in German regions on current levels of new business formation. We find that not all categories of self-employment in the year 1925 explain current regional levels of entrepreneurship equally as well. While, for example, we find a relatively strong effect for self-employment in non-agricultural private sector industries and in knowledge-intensive industries on current entrepreneurship, this effect is rather small or negligible for the self-employment rate that includes self-employed farmers, for homeworkers producing on own accounts, as well as for self-employed women. We derive hypotheses that may explain the diverging importance of these types of self-employment for a persistent regional entrepreneurship culture.

The remainder of this contribution is organized as follows. Section 2 provides an overview on recent work on the issue of persistence of

¹ We are indebted to the editors for helpful comments on an earlier draft.

² E.g. Fritsch & Mueller (2007), Andersson & Koster (2011), Fotopoulos (2014), Fritsch & Wyrwich (2014).

regional entrepreneurship and sketches a basic mechanism that may explain the persistence based on the level of self-employment. We then derive hypotheses of why not all types of entrepreneurship may be equally important for explaining the persistence phenomenon (Section 3) and make the reader familiar with the data (Section 4). Section 5 presents the results of the empirical analysis; the final section (Section 6) summarizes the results and draws some conclusions.

2. Evidence on the persistence of regional entrepreneurship

A number of studies have found that the regional level of new business formation tends to be rather constant over time (e.g. Fritsch & Mueller, 2007; Andersson & Koster 2011; Fritsch & Wyrwich, 2014; Fotopoulos, 2014). One straightforward explanation for this pattern could be that regional determinants of new business formation are only changing slightly over time. Indeed, regional characteristics that are positively related to entrepreneurship, such as the qualification of the regional workforce or the employment share in small and young firms (e.g. Sutaria & Hicks 2004; Fritsch & Falck, 2007; Wagner, 2004), tend to be relatively stable over time periods of 10 to 20 years (Fotopoulos, 2014). Another explanation for the pronounced persistence of regional entrepreneurship may be found in different regional cultures (e.g. Andersson & Koster, 2011; Fritsch & Wyrwich, 2014). Entrepreneurial culture may be particularly relevant for explaining persistence of regional patterns in the case of Germany where a considerable number of economic and political shocks took place over the course of the 20th century (Fritsch & Wyrwich, 2014).

A number of different definitions of what an entrepreneurial culture is can be found in the literature. It is, for example, described as a “positive collective programming of the mind” (Beugelsdijk, 2007, 190) or an “aggregate psychological trait” (Freytag & Thurik, 2007, 123) of the local population. A further characteristic of regions with a well-developed entrepreneurial culture could be that values such as individualism, independence, and achievement (e.g. McClelland, 1961; Hofstede & McCrae, 2008) are widespread among the inhabitants. A culture of

entrepreneurship can be regarded as an informal institution that comprises norms, values, and codes of conduct (Baumol, 1990; North, 1994). Regions with a pronounced entrepreneurial culture should be characterized by a high level of social acceptance or “legitimacy” of entrepreneurship (Etzioni, 1987; Kibler et al., 2014). They should also have a high share of persons with pronounced entrepreneurial personality traits such as extraversion, openness to experience and conscientiousness, as well as with a high ability to bear risk (Rauch & Frese, 2007; Zhao & Seibert, 2006; Obschonka et al., 2013). A number of studies provide evidence that a culture of entrepreneurship can vary substantially across space within countries that have a uniform framework of formal institutions.³

Given the observation that informal institutions only change very slowly (North, 1994; Williamson, 2000), a culture of entrepreneurship should be rather long-lasting. In contrast to the persistence of informal institutions, formal institutions such as property rights, governance structures and modes of resource allocation may change rather rapidly – although they are embedded in the informal institutions.⁴ In a recent investigation of entrepreneurship in Germany, we found compelling evidence for the persistence of regional entrepreneurship over a period of 80 years from 1925 to 2005 (Fritsch & Wyrwich, 2014). Since this period was characterized by a number of radical changes of the political-economic environment, the persistence found cannot be caused by stability of the determinants of entrepreneurship but may be regarded to indicate the effect of an entrepreneurship culture.

The reasons for the persistence of a regional entrepreneurship culture are still unclear. One possible explanation could be the presence of entrepreneurial role models and the transmission of a positive

³ For example, Andersson (2012), Aoyama (2009), Beugelsdijk (2007), Davidsson (1995), Davidsson & Wiklund (1997), Etzioni (1987), Kibler, Kautonen & Fink (2014), Rentfrow, Gosling & Potter (2008), Westlund & Bolton (2003), Westlund & Adam (2010), and Westlund, Larsson & Olsson (2014).

⁴ East Germany is a good example of the differences between formal and informal institutions. With the reunification of Germany in 1990, the ready-made West German framework of formal institutions became effective practically overnight. However, more than two decades later a specific East German mentality can still be identified.

entrepreneurial attitude in the regional population across generations (Laspita et al., 2012). Entrepreneurial role models provide a non-pecuniary externality that reduces ambiguity and influences the decision to pursue an entrepreneurial career (Minniti, 2005). Furthermore, observing active entrepreneurs, especially successful ones, may increase social acceptance of entrepreneurship and self-confidence of people in regard to their ability to successfully set up an own business (Stuart & Sorenson 2003; Bosma et al., 2012; Kibler et al., 2014). In this way, entrepreneurial role models may establish and reinforce a regional culture of entrepreneurship.

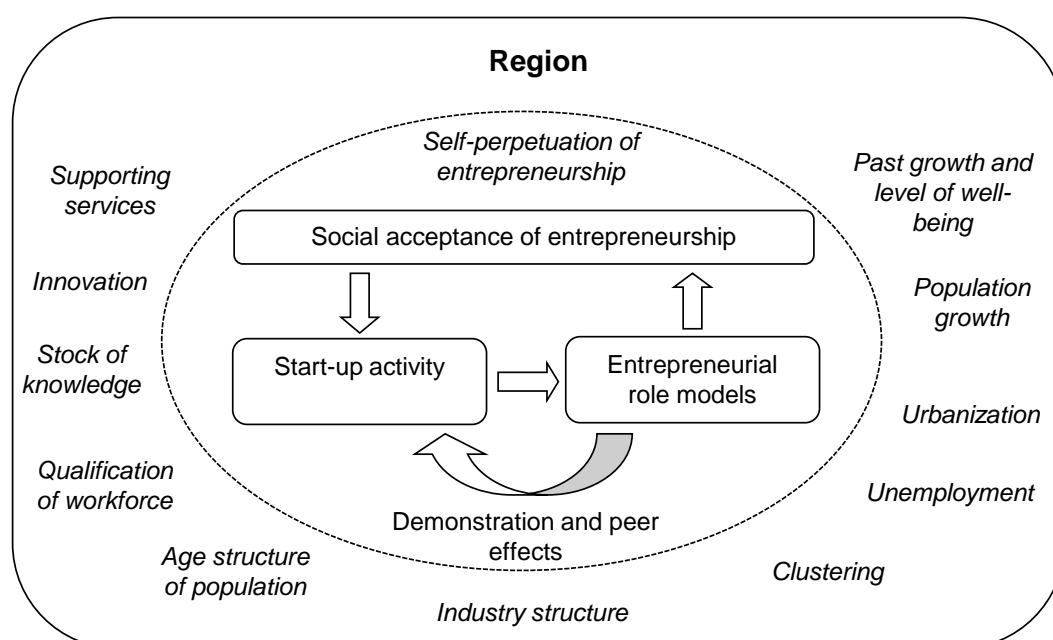


Figure 1: Determinants of new business formation and channels of self-perpetuation of regional entrepreneurship

Figure 1 shows the interplay of these factors that may lead to a self-perpetuation of regional levels of entrepreneurship. It describes the virtuous circle by which high levels of new business formation lead to large numbers of entrepreneurial role models that may, in turn, trigger social acceptance of entrepreneurship over time. The high level of acceptance or “legitimacy” (Etzioni, 1987; Kibler et al., 2014) of entrepreneurship may stimulate entrepreneurial intentions among the population and the likelihood that people will decide to follow an entrepreneurial career path –

again resulting in high start-up rates. Over time, the high levels of entrepreneurial activity and the social acceptance of entrepreneurship can also have an effect on the regional environment. A high demand for finance and advice may, for example, induce the emergence of a supporting infrastructure for entrepreneurship in fields such as finance and consulting services for newly founded businesses. Moreover, because most start-ups remain small, regions with high levels of new business formation tend to have many small firms that are well known for functioning as a fruitful seedbed for start-ups (Parker, 2009).

3. Why should different forms of entrepreneurship matter for persistence?

While it appears plausible that historical rates of entrepreneurship indicate the extent of a regional culture of entrepreneurship, there are a number of arguments suggesting that not all types of entrepreneurship may represent this entrepreneurship culture to the same degree. One may, for example, claim that successful entrepreneurs whose ventures are opportunity based are more likely to induce positive role model and peer effects in the sense of “if they can do it, I can too” (Sorenson & Audia, 2000, 443) than entrepreneurs who are in business mainly out of necessity. Furthermore, self-employment in certain industries may be more significant for the perpetuation of an entrepreneurial culture based on role models and social acceptance of entrepreneurship than self-employment in other industries.

In order to throw more light on these issues we extend our earlier analysis (Fritsch & Wyrwich, 2014) by distinguishing between different forms of self-employment in the year 1925. One distinction is made between general self-employment and self-employment in non-agricultural private sector industries. The idea behind this categorization is that self-employment in non-agricultural parts of the economy is related to industrialization and economic development. It should therefore reflect more positively perceived role models and should be more closely associated with the generation of additional entrepreneurial opportunities than general self-employment that includes entrepreneurship in agriculture

and in semi-private industries.⁵ In a similar vein, entrepreneurship in knowledge-intensive industries may particularly foster the prevalence of positive entrepreneurial role models if entrepreneurial activities in these industries spur regional development. Moreover, Entrepreneurship in knowledge intensive industries may generate relatively large numbers of further entrepreneurial opportunities. For these reasons we expect:

H1: Self-employment in non-agricultural private sector industries plays a more important role for the persistence of entrepreneurship than self-employment in general.

H2: Self-employment in knowledge-intensive industries plays a more important role for the persistence of entrepreneurship than in non-knowledge intensive industries.

There are two types of self-employment in our historical data that can be assumed to include relatively large shares of necessity driven entrepreneurship. These are self-employment by women and “domestic self-employment” by home workers (*Heimgewerbetreibende*). The role of women in the economic, political, and legal spheres of Imperial Germany, (until 1918) and also in the Weimar Republic of the 1920s, was rather marginal. The Code Civil that became effective in the 19th century is especially revealing and stipulates that all important decisions within marriage are made by the husband. Accordingly, women had the “legal and economic status of social outsiders” (Schaser, 2008, 147). Women’s legal position slowly improved in the 1920s, but nevertheless informal gender roles were largely persistent. Accordingly, self-employment by women did not reflect a socially well-accepted behavior around this time and is quite likely to have been mainly driven by necessity. Becker (1937), for instance, reports that many self-employed women in the 1920s were widows whose husbands had died throughout World War I. Given that self-employment by women reflects primarily necessity entrepreneurship,

⁵ In the semi-private industries it is not possible to clearly assign economic units to the private and the state based on the available historical dataset. One example is the sector “Transport and Communications” which comprises several private but also many public companies and employment. “Self-employed” in these industries can be true entrepreneurs but also managers of state-owned units.

the prevalence of self-employed women in the early 20th century should be only weakly or not at all related to persistence of entrepreneurship.

Another form of primarily necessity-driven entrepreneurship in a historical perspective are self-employed home workers. This group performed narrowly defined tasks at home for just one or for very few firms and falls midway between an independent entrepreneur and a dependent employee (Statistik des Deutschen Reichs, 1927, 11). In the contemporaneous context, one can characterize this group as the dependent self-employed (Roman et al., 2011). This pronounced dependence is a distinguishing feature of home workers and reflects a kind of necessity entrepreneurship. Accordingly, the prevalence of home workers in the early 20th century should be only weakly or not at all related to the persistence of entrepreneurship. Based on these considerations, the following hypotheses regarding necessity driven entrepreneurship can be formulated:

H3: The historical prevalence of self-employment by women plays a marginal role for persistence in entrepreneurship as compared to historical self-employment by men.

H4: The historical level of home working plays a marginal role for persistence in entrepreneurship as compared to historical non-domestic self-employment.

4. Data

Our empirical analysis is based on data on current start-up activity and historical self-employment rates in German regions. The data on new business formation are drawn from the Establishment History File of the Institute of Employment Research (IAB, Nuremberg). This dataset contains every establishment in Germany that employs at least one person obliged to make social insurance contributions (Gruhl et al., 2012; Hethey & Schmieder, 2010). Establishments without any employees, i.e., solo-self-employment ventures, are not included in this data. The currently available information from the Establishment History Panel covers the years 1975 to 2010 and includes identifying start-ups from 1976 onwards. Information about the historical levels of entrepreneurship is taken from an

extensive census of the year 1925 (Statistik des Deutschen Reichs, 1927). This historical data includes detailed information on the number of employees by gender, by 26 industries, as well as by “social status” at the level of counties (*kleinere Verwaltungsbezirke*). The variable “social status” distinguishes between blue collar workers, white collar employees, self-employed, homeworkers, and helping family members.

Our indicator for current levels of entrepreneurship is the average start-up rates for the time period of 1976 to 2010. We use three alternative definitions of this rate. The first of these definitions is the number of newly founded businesses over total employment in the region including employees in the public sector. A second definition is the number of newly founded businesses over the number of private sector employees. The reason for using these two definitions is that the number of private sector employees in the denominator may be influenced by a historically high level of entrepreneurship which is to a lesser degree the case for total employment. The third definition, the sector-adjusted start-up rate, accounts for differences of the regional industry structures and respective industry-specific entry conditions.⁶

Although the definition of administrative districts in the 1920s was different from what is defined as a district today, it is nevertheless possible to assign the historical districts to current planning regions which represent functionally integrated spatial units comparable to labor market areas in the United States. If a historical district is located in two or more current planning regions, we assigned the employment to the respective planning regions based on each region’s share of the geographical area. Thus, our regression framework is based on the 70 planning regions of West

⁶ The sector-adjusted number of start-ups is defined as the number of new businesses in a region that would be expected if the composition of industries was identical across all regions. Thus, the measure adjusts the original data by making industry composition uniform across regions. The adjustment procedure is based on the regional distribution of 59 industries and follows a shift-share technique (Ashcroft et al., 1991 and the Appendix of Audretsch & Fritsch, 2002). We calculate the sector adjusted rates for every year of the 1976 to 2010 period and use the average values of these yearly rates.

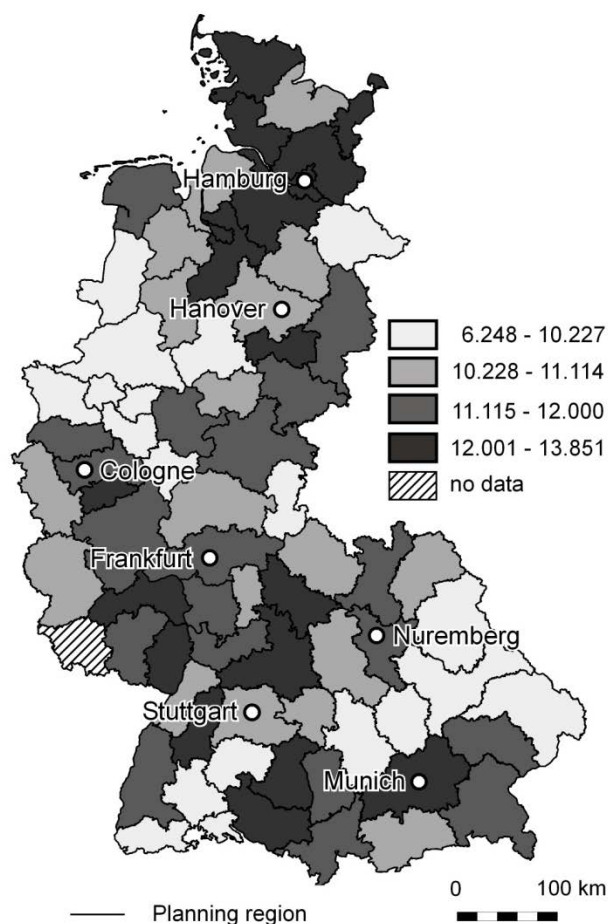


Figure 2: Self-employment rate in non-agricultural industries 1925

Germany.⁷ Figure 2 shows the spatial distribution of the self-employment rate in the non-agricultural sector of the economy in the year 1925, Figure 3 depicts the regional share of homeworkers in this year, and the average regional start-up rate of the 1976-2010 period is shown in Figure 4.

In 1925, the self-employment rate in non-agricultural industries was particularly high in the northern part of Germany, in the south around Munich, and in certain regions of Baden-Wuerttemberg in the southwest, whereas the Ruhr area (north of Cologne) was marked by relatively low rates of self-employment (Figure 2). The homeworker rate in 1925 shows

⁷ There are 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 is merged with the region of Schleswig-Holstein South and Hamburg-Umland-South. Bremen is merged with Bremen-Umland. Further, we exclude the planning region "Saarland" from the regression analysis since most of the areas within this planning region was not completely under German administration at the time of the 1925 census.

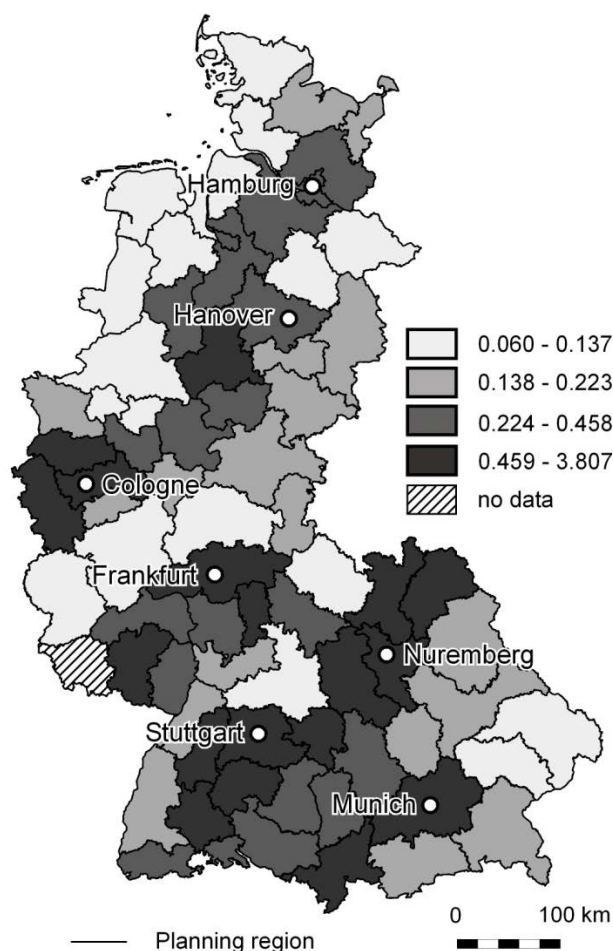


Figure 3: Home worker rate in non-agricultural industries

a quite different spatial pattern (Figure 3) with rather high rates around Stuttgart and in regions close to Nuremberg. The average start-up activity today (Figure 4) shows some considerable correspondence with the historical level of self-employment in non-agricultural industries in 1925, but there are also some notable deviations such as the low start-up rates in most parts of Baden-Wuerttemberg.

In order to test the effect of the different types of historical entrepreneurship on the level of new business formation in the years 1976 to 2010, we regress the average yearly start-up rates for this period on different definitions of the historical self-employment rates including a number of control variables. The overall level of self-employment is given by the overall number of self-employed divided by the total number of employees. The self-employment in the non-agricultural private sector is

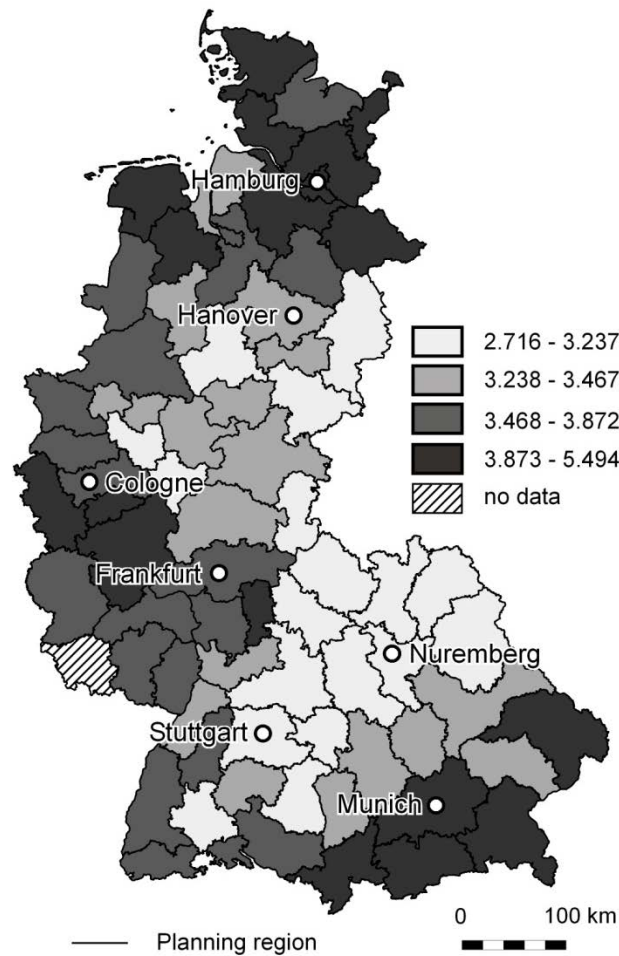


Figure 4: Average start-up rate 1976-2010

the number of self-employed in manufacturing and services over all employees. We also test the effect of the self-employment rate of men and woman and the rate of homeworkers. Self-employed in “machine, apparatus, and vehicle construction“, “electrical engineering, precision mechanics, optics”; “chemical”, and “rubber- and asbestos“ are regarded as knowledge-intensive. The numbers of self-employed in these industries are divided by the total number of employees.

As control variables for regionally different conditions for entrepreneurship we use the share of manufacturing employment in 1925, the population share of expellees in 1950 as well as population density

Table 1: Definition of variables

<i>Variable</i>	<i>Definition</i>
Average start-up rate 1976-2010 (total employment)	Number of start-ups in a region per year over the total number of employees. ^b
Average start-up rate 1976-2010 (private sector employment)	Number of start-ups in a region per year over total private sector employment. ^b
Average sector adjusted start-up rate 1976-2010	Sector adjusted number of start-ups in a region over total employment. ^b
Self-employment rate 1925	Total number of self-employed persons divided by the total number of employees. ^a
Self-employment rate in non-agricultural industries 1925	Number of self-employed persons in non-agricultural private industries divided by the total number of employees. ^a
Self-employment rate females in non-agricultural industries 1925	Number of self-employed women in non-agricultural private industries divided by all working women. ^a
Self-employment rate males in non-agricultural industries 1925	Number of self-employed men in non-agricultural private industries divided by all working men. ^a
Home worker rate in non-agricultural industries 1925	Number of persons registered as home worker in non-agricultural private industries divided by the total number of employees. ^a
Share of self-employed women over total self-employment 1925	Number of self-employed women in in non-agricultural private industries over the total number of persons registered as self-employed in these industries ^a
Self-employment rate in non-agricultural industries (incl. home workers) 1925	Number of self-employed persons and number of home workers in non-agricultural private industries divided by the total number of employees. ^a
Share of home workers over total self-employment 1925	Number of home worker 1925 in non-agricultural private industries over all self-employed and homeworkers in non-agricultural private industries.
Self-employment rate in knowledge intensive industries 1925	Number of self-employed persons in knowledge-intensive industries ("machine, apparatus, and vehicle construction", "electrical engineering, precision mechanics, optics"; "chemical", and "rubber- and asbestos") divided by the total number of employees. ^a
Self-employment rate in non-knowledge intensive industries 1925	Number of self-employed persons in non-knowledge-intensive industries divided by the total number of employees. ^a
Employment share in knowledge-intensive industries 1925	Number of employees in knowledge-intensive industries divided by the total number of employees. ^a
Employment share in non-knowledge-intensive industries 1925	Number of employees in non-knowledge-intensive industries divided by the total number of employees. ^a
Employment share in manufacturing 1925	Number of employees in manufacturing divided by the total number of employees. ^a
Population share of expellees 1950	Number of expellees over regional population. ^d
Population density 1974	Number of inhabitants in per km ² . ^c
Share of R&D employees 1976	Number of employees working as engineers and natural scientists divided by the total number of employees. ^c

Source: a) Statistik des Deutschen Reichs (1927); b) Social Insurance Statistics; c) Federal Statistical Office; d) Census 1950 (various volumes). All variables enter the models in log-form.

and the share of R&D employees⁸ in the year 1976. The population share of expellees is taken from the 1950 Census and is included to account for the massive inflow of people from outside the region after World War II that might have had an influence on the regional culture of entrepreneurship. Table 1 provides an overview on the definition of the variables used in the analysis. Table A1 in the Appendix shows descriptive statistics and Table A2 and A3 show correlations between the variables.

5. Empirical analysis

We begin our analysis with the 1925 overall self-employment rate (Table 2) and then move on to other definitions of self-employment (Tables 3 to 5). Regressing the entire share of people that have been counted as self-employed in 1925 on the average start-up rate of the period from 1976 to 2010 (Table 2) shows no robust significant relationship. Restricting the definition of entrepreneurship to the non-agricultural private sector, we find a positive effect in all versions of the model, i.e. regardless of how far regional differences in industry structures and entry conditions are accounted for (Table 3). These results are in accordance with our Hypotheses H1.⁹

In the models presented in Tables 2 and 3 the specialization in manufacturing industries in 1925 that controls for sector-specific effects at that time is negatively related to the level of start-up activity in the period from 1976 to 2010. This effect is, however, only found to be statistically significant in models II and III. An explanation could be that regions with a high share of manufacturing employment in the year 1925 still have relatively high levels of manufacturing activities that are characterized by higher entry barriers than other sectors. There is indeed a high correlation

⁸ R&D employees are defined as those with tertiary degrees working as engineers or natural scientists. Population density is a “catch-all” variable for regional conditions that captures many of the region-specific conditions shown in Figure 1.

⁹ Running the models with the self-employment rate in agriculture (self-employed farmers divided by the total number of employees) reveals that there is no significant relationship with current start-up activity.

Table 2: General self-employment rate 1925 and regional levels of start-up activity in the 1976-2010 period

	Number of start-ups divided by ...			Sector-adjusted start-up rate
	total employment	private sector employment	private sector employment	
Self-employment rate 1925	0.00569 (0.0360)	-0.0120 (0.146)	-0.0879 (0.167)	0.00532 (0.0956)
Employment share in manufacturing 1925	-	-0.158** (0.0633)	-0.247*** (0.0650)	-0.0222 (0.0416)
Population share of expellees 1950	-	-0.108** (0.0455)	-0.138** (0.0535)	-0.0801** (0.0326)
Population density 1974	-	0.0390 (0.0693)	0.0253 (0.0825)	-0.0796* (0.0451)
Share of R&D employees 1976	-	-0.00189 (0.0492)	0.00337 (0.0512)	-0.0890*** (0.0327)
Federal State dummies	No	Yes***	Yes***	Yes***
Constant	1.251*** (0.0581)	0.542 (0.459)	0.654 (0.504)	1.075*** (0.283)
R ²	0.000	0.333	0.486	0.577

Notes: N=70. Robust 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 independent variables (except the Federal State dummies) are entered as log values.

Table 3: Self-employment rate in the non-agricultural private sector 1925 and persistence of regional entrepreneurship

	I	II	III	IV
	Number of start-ups divided by ...			Sector-adjusted start-up rate
	total employment	private sector employment	private sector employment	
Self-employment rate in non-agricultural industries 1925	0.244** (0.107)	0.314*** (0.103)	0.294** (0.134)	0.197*** (0.0658)
Employment share in manufacturing 1925	-	-0.191*** (0.0523)	-0.273*** (0.0633)	-0.0441 (0.0365)
Population share of expellees 1950	-	-0.118** (0.0475)	-0.142** (0.0547)	-0.0871** (0.0344)
Population density 1974	-	0.0789* (0.0416)	0.0934* (0.0503)	-0.0597** (0.0232)
Share of R&D employees 1976	-	-0.0376 (0.0494)	-0.0306 (0.0533)	-0.111*** (0.0325)
Federal State dummies	No	Yes***	Yes***	Yes***
Constant	1.782*** (0.240)	0.760* (0.384)	0.812* (0.445)	1.220*** (0.261)
R ²	0.055	0.386	0.510	0.603

Notes: N=70. Robust 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 independent variables (except the Federal State dummies) are entered as log values.

between the share of employment in manufacturing in 1925 and the respective share today ($r = 0.43$ for the mid-1970s and $r = 0.23$ on average for the period from 1976 to 2010). That the effect becomes insignificant when the current sector adjusted start-up rate is taken as the dependent variable is not surprising since this version of the start-up rate already accounts for sector-specific effects. The population share of expellees shortly after World War II is negatively related to the start-up rate regardless of the sector-adjustment. The reason might be that expellees either had a relatively low propensity of starting an own business or have typically settled in regions with low entrepreneurial opportunities.¹⁰ Population density and the share of R&D employees are only weakly or not at all related to the uncorrected start-up rate (model II), whereas there is a negative relationship in the model for the sector-adjusted rate (model IV).¹¹

Distinguishing different types of self-employment in the non-agricultural private sector shows a significantly positive effect only for self-employed males (Table 4). Self-employment of females and homeworkers that probably comprises a high share of necessity entrepreneurship are not statistically significant. These results are in accordance with our Hypotheses H3 and H4.¹²

¹⁰ The average regional self-employment rate among expellees in 1950 was 4.1 percent whereas the self-employment rate of the original local population was about 14.2 percent. Thus, given that the entrepreneurial propensity of expellees was indeed considerably lower, a high population share of expellees accordingly feeds back into relatively low start-up activity. Furthermore, there is a positive correlation of $r = 0.43$ between the population share of expellees and the self-employment rate in 1950. This suggests that expellees were not particularly relocated in regions with below average levels of entrepreneurial activity

¹¹ The insignificance of the share of R&D employees in the models for the start-up rate and the negative effect in the models for the sector-adjusted rate of new firm formation is somewhat surprising since we have quite stable and significant positive effects for this variable in earlier work (Fritsch and Wyrwich 2014). This positive effect is confirmed when restricting our analysis to the more recent sub-period 1992 to 2010 and applying pooled regression. A possible reason for the differences in the results may be an increase of R&D activities in smaller firms over the last decades that might be more likely to induce start-up activity as compared to R&D-activities in large firms. Unfortunately, we cannot test this conjecture with the dataset at hand.

¹² We also run robustness check with the self-employment rate in non-agricultural industries 1925 and the share of homeworkers and self-employed women respectively that confirm the results of Table 4 (see Table A4 and A5 in the Appendix).

Table 4: Different forms of self-employment and persistence of regional entrepreneurship

	Number of start-ups divided by ...			Sector-adjusted start-up rate
	total employment	private sector employment		
Self-employment rate males in non-agricultural industries 1925	0.218** (0.0860)	0.277*** (0.0803)	0.275** (0.117)	0.171*** (0.0551)
Self-employment rate of females in non-agricultural industries 1925	0.0983 (0.0838)	-0.0549 (0.128)	-0.0589 (0.152)	-0.00271 (0.0955)
Home worker rate in non-agricultural industries 1925	-0.0340* (0.0174)	0.0112 (0.0222)	0.00379 (0.0251)	0.00309 (0.0148)
Employment share in manufacturing 1925	-	-0.245*** (0.0733)	-0.311*** (0.0893)	-0.0623 (0.0452)
Population share of expellees 1950	-	-0.111** (0.0482)	-0.135** (0.0568)	-0.0851** (0.0337)
Population density 1974	-	0.0855** (0.0378)	0.101** (0.0485)	-0.0572** (0.0223)
Share of R&D employees 1976	-	-0.0120 (0.0501)	-0.0109 (0.0597)	-0.104*** (0.0340)
Federal State dummies	No	Yes***	Yes***	Yes***
Constant	1.753*** (0.266)	0.653 (0.402)	0.678 (0.476)	1.177*** (0.312)
R ²	0.117	0.406	0.522	0.608

Notes: N=70. Robust 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 independent variables (except the Federal State dummies) are entered as log values.

Finally, we investigate the role of entrepreneurship in knowledge-intensive industries (Table 5). We run a “horse race” in our regression models where we include self-employment knowledge-intensive non-agricultural industries in 1925 along with the self-employment rate in non-knowledge intensive non-agricultural private sector industries. Additionally, we include the employment shares of both sectors in 1925 in order to control for their relevance in the local economy. The results suggest especially that historical self-employment in knowledge-intensive industries can be regarded as a driver of a persistent entrepreneurship culture, whereas self-employment in other private sectors is not significantly related to current start-up activity. These findings are in line with our Hypothesis H2. The results for the control variables in Tables

Table 5: Knowledge intensity of industries and persistence of regional entrepreneurship

	Number of start-ups divided by ...			Sector-adjusted start-up rate
	I total employment	II private sector employment	III	
Self-employment rate in knowledge intensive industries 1925	0.280*** (0.0624)	0.303*** (0.0899)	0.265** (0.110)	0.189*** (0.0526)
Self-employment rate in non-knowledge intensive industries 1925	-	-0.0500 (0.163)	-0.0648 (0.210)	0.00257 (0.0929)
Employment share in knowledge-intensive industries 1925	-0.139*** (0.0340)	-0.140*** (0.0327)	-0.154*** (0.0386)	-0.0801*** (0.0220)
Employment share in non-knowledge-intensive industries 1925	-	0.156 (0.170)	0.204 (0.199)	0.175 (0.109)
Population share of expellees 1950	-0.0921** (0.0451)	-0.0992** (0.0440)	-0.135** (0.0516)	-0.0769** (0.0326)
Population density 1974	0.0586 (0.0376)	0.0123 (0.0707)	-0.00406 (0.0896)	-0.0989*** (0.0370)
Share of R&D employees 1976	0.00644 (0.0472)	0.00725 (0.0501)	0.0244 (0.0558)	-0.0853** (0.0340)
Federal State dummies	No	Yes***	Yes***	Yes***
Constant	1.942*** (0.516)	2.296*** (0.761)	2.415** (0.978)	2.192*** (0.449)
R2	0.443	0.456	0.506	0.686

Notes: N=70. Robust 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 independent variables (except the Federal State dummies) are entered as log values.

4 and 5 are in line with the former models presented in Tables 2 and 3. It should be noted that the historical employment share in knowledge intensive industries is negatively related to current start-up activity. Since the respective industries are belonging to the manufacturing sector they are characterized by relatively high entry barriers. Due to industrial path-dependency, regions historically specialized in these industries might have specialized in industries with similar entry conditions which might explain the negative relationship. There is indeed a high correlation between the employment share in knowledge-intensive industries in 1925 and the share of R&D employment in 1976 ($r = 0.67$).

6. Conclusions

Recent research has shown that regional differences in entrepreneurial activities are characterized by pronounced long-term persistence. The empirical evidence suggests that a considerable part of this persistence

can be attributed to regional culture of entrepreneurship. Assuming that demonstration and role-model effects are a key mechanism for the self-perpetuating nature of such a culture, we have investigated the role of different types of self-employment for the persistence of regional entrepreneurship.

We find indeed that not all types of self-employment are equally important for the long-term persistence of regional entrepreneurship. While the overall level of self-employment that includes agriculture and semi-public sectors is only weakly related to the current level of new business formation, we find a rather pronounced positive effect for the share of self-employed males in non-agricultural industries as well as for self-employment in knowledge-intensive industries. Self-employment by women and the share of homeworkers that may both include large shares of necessity driven entrepreneurship do not contribute to an explanation of persisting regional differences in the level of new business formation.

Our findings have a number of implications. First of all, not the sheer number of start-ups and self-employed persons is important for the persistence of a regional entrepreneurship culture, but particularly those forms of entrepreneurship that can be assumed to be most relevant for growth. Hence, policies that aim at fostering a persistent culture of entrepreneurship may focus on those types of new businesses. Second, attempts to measure a regional culture should account for such differences and should therefore also focus on those types of entrepreneurship that have a longer-lasting effect. Third, the persistence of start-up activity shows that policy initiatives that aim at creating an entrepreneurial culture need a long-term orientation. Effects of such policies may become visible only after longer periods of time. However, once these effects become manifest, they may be long-lasting.

One important question that we have not mentioned yet is that the characteristics of historically-grown entrepreneurship cultures might differ across regions, and there may also be differences in the importance of the mechanisms by which such a culture persists over longer periods of time. To identify and analyze such differences could considerably enhance our

understanding of the phenomenon. In this paper we have attempted to make a step in this direction.

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Appendix

Table A1: Descriptive statistics

	Mean	Minimum	Maximum	Standard Deviation
Average start-up rate 1976-2010 (total employment)	3.597	2.716	5.589	0.536
Average start-up rate 1976-2010 (private sector employment)	4.795	3.356	7.927	0.897
Average sector adjusted start-up rate 1976-2010	3.778	2.734	5.727	0.501
Self-employment rate 1925	0.24	0.074	0.41	0.077
Self-employment rate in non-agricultural industries 1925	0.109	0.062	0.139	0.013
Self-employment rate females in non-agricultural industries 1925	0.08	0.055	0.122	0.014
Self-employment rate males in non-agricultural industries 1925	0.12	0.057	0.153	0.016
Home worker rate 1925	0.006	0.001	0.06	0.009
Share of self-employed women over total self-employment 1925	0.187	0.13	0.243	0.026
Self-employment rate (incl. home worker) 1925	0.115	0.063	0.163	0.016
Share of home worker over total self-employment 1925	0.048	0.005	0.369	0.064
Self-employment rate in knowledge intensive industries 1925	0.004	0.002	0.007	0.001
Self-employment rate in non-knowledge intensive industries 1925	0.106	0.061	0.136	0.013
Employment share in knowledge intensive industries 1925	0.053	0.007	0.169	0.037
Employment share in non-knowledge intensive industries 1925	0.562	0.34	0.881	0.124
Employment share in manufacturing 1925	0.257	0.117	0.547	0.093
Population share of expellees 1950	0.172	0.033	0.363	0.083
Population density 1974	5.347	4.237	7.126	0.682
Share of R&D employees 1976	0.01	0.002	0.028	0.005

Table A2: Correlation between contemporaneous start-up rates and historical self-employment rates

	Average start-up rate 1976-2010 (total employment)	Average start-up rate 1976-2010 (private sector employment)	Average sector adjusted start-up rate 1976-2010
Average start-up rate 1976-2010 (total employment)	1		
Average start-up rate 1976-2010 (private sector employment)	0.947***	1	
Average sector adjusted start-up rate 1976-2010	0.592***	0.48***	1
Self-employment rate in non-agricultural industries 1925	0.234*	0.157	0.196
Self-employment rate females in non-agricultural industries 1925	0.178	0.197	-0.078
Self-employment rate males in non-agricultural industries 1925	0.191	0.094	0.217*
Home worker rate 1925	-0.196	-0.342***	-0.043
Self-employment rate 1925	0.014	-0.065	0.566***
Share of self-employed women over all self-employed 1925	0.006	-0.085	-0.129
Self-employment rate [incl. home worker] 1925	0.135	0.019	0.187
Share of home worker over all self-employed and homemaker 1925	-0.233*	-0.371***	-0.076
Self-employment rate [knowledge intensive industries] 1925	-0.016	-0.15	-0.153
Self-employment rate [non-knowledge intensive industries] 1925	0.243**	0.174	0.211*

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

Table A3: Correlation matrix (Independent variables)

	1	2	3	4	5	6	7	8
1 Self-employment rate in non-agricultural industries 1925	1							
2 Self-employment rate females in non-agricultural industries 1925	0.376***	1						
3 Self-employment rate males in non-agricultural industries 1925	0.955***	0.102***	1					
4 Home worker rate in non-agricultural industries 1925	0.153***	-0.251***	0.279***	1				
5 General self-employment rate 1925	0.421***	0.048***	0.408***	-0.152***	1			
6 Share of self-employed women over all self-employed 1925	-0.032*	0.532***	-0.119***	0.075***	-0.155***	1		
7 Self-employment rate [incl. home worker] 1925	0.868***	0.154***	0.895***	0.557***	0.303***	-0.072***	1	
8 Share of home worker over all self-employed and homemaker 1925	0.035*	-0.293***	0.167***	0.992***	-0.208***	0.092***	0.451***	1
9 Self-employment rate [knowledge intensive industries] 1925	0.467***	0.064***	0.523***	0.369***	-0.058***	0.240***	0.456***	0.329***
10 Self-employment rate [non-knowledge intensive industries] 1925	0.998***	0.385***	0.947***	0.130***	0.437***	-0.048***	0.862***	0.011
11 Employment share in knowledge-intensive industries 1925	0.116***	0.067***	0.132***	0.307***	-0.537***	0.135***	0.167***	0.305***
12 Employment share in non-knowledge-intensive industries 1925	-0.139***	0.072***	-0.138***	0.317***	-0.903***	0.158***	0.001	0.341***
13 Population share of expellees 1950	0.083*	-0.257***	0.149***	-0.168***	0.107***	-0.188***	0.056***	-0.190***
14 Employment share in manufacturing 1925	0.039**	-0.074***	0.107***	0.666***	-0.542***	0.173***	0.280***	0.675***
15 Population density 1974	-0.237***	0.155***	-0.265***	0.230***	-0.835***	0.233***	-0.160***	0.273***
16 Share of R&D employees 1976	0.096	0.284***	0.057	0.083	-0.52***	0.360***	0.022	0.086

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

Table A3 continued

	9	10	11	12	13	14	15
1 Self-employment rate in non-agricultural industries 1925							
2 Self-employment rate females in non-agricultural industries 1925							
3 Self-employment rate males in non-agricultural industries] 1925							
4 Home worker rate in non-agricultural industries 1925							
5 Self-employment rate 1925							
6 Share of self-employed women over all self-employed 1925							
7 Self-employment rate [incl. home worker] 1925							
8 Share of home worker over all self-employed and homemaker 1925							
9 Self-employment rate [knowledge intensive industries] 1925	1						
10 Self-employment rate [non-knowledge intensive industries] 1925	0.408***	1					
11 Employment share in knowledge-intensive industries 1925	0.628***	0.074***	1				
12 Employment share in non-knowledge-intensive industries 1925	0.154***	-0.152***	0.540***	1			
13 Population share of expellees 1950	-0.127***	0.097***	-0.232***	-0.158***	1		
14 Employment share in manufacturing 1925	0.479***	0.005	0.741***	0.692***	-0.351***	1	
15 Population density 1974	0.289***	-0.263***	0.655***	0.832***	-0.390***	0.691***	1
16 Share of R&D employees 1976	0.507***	0.065	0.721***	0.522***	-0.256***	0.560***	0.681***

Table A4: Self-employment rates and persistence of entrepreneurship: the role of home working self-employed and of gender

	I	II	III	IV
	Number of start-ups divided by ...			Sector-adjusted start-up rate
	total employment		private sector employment	
Self-employment rate1925	0.245** (0.107)	0.365*** (0.117)	0.340** (0.154)	0.213*** (0.0769)
Share of self-employed women over total self-employment 1925	0.0220 (0.138)	0.210 (0.216)	0.189 (0.231)	0.0649 (0.149)
Employment share in manufacturing 1925		-0.180*** (0.0515)	-0.263*** (0.0617)	-0.0406 (0.0352)
Population share of expellees 1950		-0.139*** (0.0431)	-0.161*** (0.0538)	-0.0936*** (0.0311)
Population density 1974		0.0755* (0.0409)	0.0903* (0.0492)	-0.0608** (0.0232)
Share of R&D employees 1976		-0.0757 (0.0638)	-0.0650 (0.0724)	-0.123*** (0.0407)
Federal State dummies	No	Yes***	Yes***	Yes***
Constant	1.822*** (0.336)	0.984** (0.480)	1.013* (0.521)	1.289*** (0.333)
R ²	0.055	0.406	0.052	0.606

Notes: N=70. Robust 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 independent variables (except the Federal State dummies) are entered as log values.

Table A5: Self-employment rates and persistence of entrepreneurship: the role of home working self-employed

	I	II	III	IV
	Number of start-ups divided by ...			Sector-adjusted start-up rate
	total employment		private sector employment	
Self-employment rate (incl. home worker) 1925	0.267*** (0.0949)	0.258** (0.105)	0.240 (0.145)	0.163** (0.0656)
Share of home worker over total self-employment 1925	-0.0526*** (0.0182)	0.00321 (0.0256)	-0.00303 (0.0329)	-0.00328 (0.0158)
Employment share in manufacturing 1925		-0.227*** (0.0779)	-0.293*** (0.0896)	-0.0552 (0.0479)
Population share of expellees 1950		-0.117** (0.0482)	-0.141** (0.0562)	-0.0869** (0.0350)
Population density 1974		0.0712* (0.0395)	0.0857* (0.0483)	-0.0646*** (0.0227)
Share of R&D employees 1976		-0.0104 (0.0457)	-0.00905 (0.0513)	-0.0978*** (0.0329)
Federal State dummies	No	Yes***	Yes***	Yes***
Constant	1.626*** (0.188)	0.769** (0.379)	0.795* (0.430)	1.207*** (0.263)
R ²	0.121	0.383	0.505	0.599

Notes: N=70. Robust 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 independent variables (except the Federal State dummies) are entered as log values.