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Abstract

Mounting empirical evidence shows that regional differences of entrepreneurship are persistent over long periods of time that may reflect the prevalence of an entrepreneurial culture. We explore three important mechanisms behind the transmission of such an entrepreneurial culture. First, we analyze the role model effects at the household level. We hypothesize that the larger the households of self-employed, the greater the opportunities for role model effects such as an intergenerational transfer of entrepreneurial values and attitudes, and hence the higher the regional start-up rate in later periods. Second, we investigate how the economic success of regional entrepreneurs fuels the role model effects. Third, we analyze if and to what extent the economic success in of regional entrepreneurship stimulates a collective memory of historical entrepreneurship that spurs self-employment in later periods. The analysis of entrepreneurship in German regions over a period of more than 90 years provides support for the significance of all three transfer channels.

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1. The historical roots of entrepreneurship[1]

Several recent studies showed stunning persistence of regional entrepreneurial activity over long periods of time. Such persistence can be found even in the case of disruptive changes in the general economic conditions such as devastating wars or radical demographic change (for an overview, see Fritsch and Wyrwich 2023). A common explanation of persistent high levels of entrepreneurship is based on the notion of a prevailing regional culture of entrepreneurship with certain values and attitudes that are supportive of entrepreneurial behavior (Fritsch and Wyrwich 2023). However, it is unclear how and through which channels such a regional entrepreneurial culture is transferred over time.

This paper analyzes two possible sources of a transfer of regional entrepreneurial activity over a time period of up to 90 years. One of these sources is the size of entrepreneurial households that reflects the magnitude of role model effects such as the intergenerational transfer of entrepreneurial attitudes (Abdellaoui et al. 2019; Vladasel et al. 2021). The general hypothesis that we test with this variable is that the larger the share of the regional population belonging to entrepreneurial households, the broader the diffusion of entrepreneurship and the higher the self-employment rate in later periods.

The second construct that we use for analyzing the transfer of entrepreneurship over time is the average income of regional self-employed. Income and, hence, the economic success of entrepreneurs in the past may have a number of effects. First, economically successful businesses are more likely to remain active in the market so that they can be passed on to future generations. Second, successful entrepreneurs have more resources available that they can inherit to their offspring, thereby supporting them to operate their own firms. Third, successful entrepreneurs can generate considerably stronger demonstration and peer effects that stimulate other persons to start their own businesses than is the case for unsuccessful entrepreneurs. Such

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[1] We are indebted to Johannes Kleinhempel, Michael Stuetzer and Martin Obschonka for helpful comments on earlier versions of this paper.

positive demonstration and peer effects may generate increasing levels of entrepreneurship in the respective time period, but can also become effective later on in the form of a collective memory that stimulates entrepreneurial behavior.

The historical data on regional self-employment, the size of entrepreneurial households, and the economic success of self-employed that we relate to current levels of entrepreneurship are for German regions in the year 1925. Germany is a particularly noteworthy case for such an analysis because of its turbulent history that includes the devastating Second World War (WWII) followed by forty years of division into a capitalist West German and a communist East German state that were re-united in 1990. Our analyses confirm the role of both mechanisms, the size of entrepreneurial families, and the economic success of self-employed back in 1925, in both East and West Germany.

The remainder of this paper is structured as follows. We begin with a brief overview of the empirical evidence (Section 2) of persistent regional entrepreneurship followed by a discussion of alternative explanations for the phenomenon that highlights the role of an entrepreneurial culture (Section 3). We then describe the two basic transfer channels of entrepreneurial culture that we investigate and the respective data in some detail (Section 4) followed by the empirical analysis (Section 5). The results are then discussed in Section 6 and the final section concludes (Section 7).

2. Persistence of entrepreneurship: empirical evidence

A growing number of empirical analyses for a variety of countries demonstrated persistence of regional self-employment over periods of different length. So far, the most detailed analyses were conducted for Germany (e.g., Fritsch and Wyrwich 2019). Other studies are for China, Great Britain, Italy, Poland, Russia, and for the US (for details, see Fritsch and Wyrwich 2023).

In Germany, historical regional levels of self-employment are significantly and positively related to self-employment and new business formation more than one hundred years later. Such a relationship is rather

unlikely, given that Germany experienced a number of disruptive shocks in the course of the twentieth century. These include the First World War (WWI), the Great Recession of the late 1920s, the Nazi regime, the devastating Second World War (WWII) as well as occupation by the Allied Powers and massive in-migration from lost territories after WWII. After WWII, the country was split into two separate states for 40 years: a western-type market economy (West Germany, the FRG) and a communist regime (East Germany, the GDR) with a Soviet-style planned economy.

The socialist regime in East Germany strongly favored collectivist values, while entrepreneurship was perceived as a bourgeois anachronism. In particular, the East German socialist regime implemented a significant number of policies intended to eradicate entrepreneurship. This included massive socialization of private companies and the suppression of any remaining private sector activity. These anti-entrepreneurial policies left their traces and resulted in much lower levels of self-employment than in West Germany. When the East German state suddenly collapsed in 1990 and both parts of the country were reunited, the self-employment rate in the East was 1.8% compared to about 9% in the West. In the course of German reunification the West German system of formal institutions was transferred to the East virtually overnight (Sinn and Sinn 1992) leading to a start-up boom there (Fritsch et al. 2022a).

Quite remarkably, there is significant correspondence between the regional structure of self-employment before WWII and the regional structure of the remaining self-employment in East Germany at the end of the socialist period. Moreover, those East German regions that had relatively high levels of remaining self-employment showed high intensities of new business formation after reunification (Fritsch, Greve and Wyrwich 2022).

3. What can explain the persistence of entrepreneurship?

The persistence of regional entrepreneurship over time can be explained in a number of different ways. One can distinguish structural and cultural explanations. The idea that the *stability of regional conditions for entrepreneurship* causes persistence belongs to structural explanations. This

type of explanation may hold in the short run or maybe for a few decades, but several examples showing persistence after serious disruptive shocks contradict such an explanation. The same holds for historical *industry specialization*. It may be the case that the specialization in a certain industry strongly shapes the level and the type of regional entrepreneurship, but industrial patterns tend to change, at least in the long run. Another relevant factor that is closely related to industry structure is the *regional knowledge base*. Although it is undisputed that knowledge may play a rather important role in the emergence of new firms (Acs et al. 2009), particularly the emergence of knowledge-intensive and innovative businesses, the persistence of such an effect would require the more or less continuous development of regional knowledge. However, the factors that shape the long-term dynamics of a regional knowledge base are largely unexplored.

Empirical research showed that regional structures may only provide an incomplete explanation of the level of entrepreneurship. In particular, regional levels of entrepreneurship tend to persist despite considerable change in economic structures. Fritsch and Wyrwich (2023) conclude from their review of available empirical evidence that a main source of persistently high levels of regional entrepreneurship is the prevalence of *regional entrepreneurial culture*. An entrepreneurial culture is typically defined as an "aggregate psychological trait" (Freytag and Thurik 2007, 123) or the "collective programming of the mind" in favor of entrepreneurship (Beugelsdijk 2007, 190). It can also be described as an informal institution that changes only rather slowly over long periods of time. On the contrary, the regulatory framework of formal rules may change rather quickly and frequently. Research has shown that informal institutions tend to maintain a high degree of independence from changes in the social, economic, and political context (North 1994; Williamson 2000). Such a pronounced robustness of a well-developed entrepreneurial culture may be a key explanation for the persistence of entrepreneurship over long periods of time and in disruptive environments.

A further explanation of persistent entrepreneurship that is strongly related to a regional entrepreneurial culture is *a collective memory of a*

region's entrepreneurial history, particularly a remembrance of successful historical entrepreneurship (for details of the concept of collective memory, see Olick et al. 2011). Such a collective memory may be manifest in regional artefacts (e.g. buildings and monuments) or in common stories and narratives that are widespread in the regional population. An important aspect of regional collective memory is that the power of these stories and narratives in shaping the behavior of the local population does not necessarily become weaker over time. On the contrary, it can well be that historical events are for some time more or less forgotten but are then re-activated and become relevant for behavior because of certain events and circumstances (for examples see Ochsner and Roesel 2017; Fouka and Voth 2022).

A persistently low level of regional entrepreneurship could be the absence of a culture and collective memory of entrepreneurship. In cases where persistent low levels of regional entrepreneurship result from a large-scale structure of the local economy, there may also exist a widespread anti-entrepreneurial attitude of the local population that favors paid employment positions in large firms or in the public sector (e.g., a 'nine-to-five' mentality) with high levels of job security. At the same time, entrepreneurial values such as individualism, autonomy, and self-realization may be neutral or even negative in such regions.[2] As a consequence, there may exist a collective memory of the regional population that is dominated by a positive image of large-scale production with well-paid and safe jobs, which may be regarded the opposite of an entrepreneurial economy (see, for example, Obschonka et al. 2018).[3]

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[2] It is an interesting result of a number of empirical studies that even after dominant large-scale industries have faded away the low levels of regional entrepreneurship tend to persist (Glaeser, Kerr and Kerr 2015; Stuetzer et al. 2016). Stuetzer et al. (2016) and Obschonka et al. (2018) find that today's population in regions of Great Britain that were formerly dominated by coal-based industries (coal mining and manufacturing industries that used coal as a main energy source) scores relatively low on those personality traits, values, and attitudes that are regarded to be entrepreneurial. The authors argue that these factors may result in a self-reinforcing vicious cycle with persistently low levels of entrepreneurship and innovation over long periods of time. One of the self-reinforcing factors could be selective migration, e.g., the outflow of entrepreneurial minded people.

[3] A further factor that may determine relatively high and low levels of regional entrepreneurship is locational fundamentals such as the 'first nature' of a region. A prominent example of such a first-nature effect on a region's industry structure is the presence of rich coal deposits. The link between proximity to coal deposits and the persistence of (low) levels

A key issue in explaining the persistence of regional entrepreneurship by prevalence of a certain culture is how the respective values and attitudes are transferred across generations. In the following, we zoom in on the transmission of a regional culture of entrepreneurship by role models of regional self-employed and their success. In particular, we discuss and hypothesize about factors that facilitate the spread and the strength of such a culture.

4. The transmission of regional entrepreneurial culture: role models and factors facilitating its spreading and strengthening

This section focuses on the impact of entrepreneurial role modeling on the persistence of entrepreneurship. We hypothesize on the number of entrepreneurial role models in a region (Section 4.1) and discuss factors that facilitate the spreading and the strength of these role model effects. Section 4.2 deals with the role of the size (number of persons) in entrepreneurial households relative to the household size of paid employees for the spread of role model effects. Section 4.3 focuses on the economic success of historic entrepreneurs that may strengthen the effect of role models and collective memory on current levels of entrepreneurship. We hypothesize that economically successful role models have a stronger effect.

4.1 Role model effects

There are several factors that determine the regional entrepreneurial culture. Fritsch and Wyrwich (2023) distinguish between a normative-cognitive and a policy layer. While the policy layer is captured by laws and regulations, the normative cognitive layer reflects the social acceptance of entrepreneurship. This includes, for example, the entrepreneurial values of the regional population, the abundance of entrepreneurial personalities, and a large number of entrepreneurial role models.

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of entrepreneurship is already well-explored (Glaeser, Kerr and Kerr 2015; Stuetzer et al., 2016). Proximity to coal promoted the emergence of large-scale industries, which is the prime mechanism affecting entrepreneurship negatively. A further example is location at a seaport or at routes of commercial trade that fosters the exchange of goods and knowledge leading to a rich regional knowledge base that is conducive to entrepreneurship (Tavassoli, Obschonka and Audretsch 2021; Fritsch et al. 2021).

Entrepreneurial role models are a particularly important factor, as entrepreneurs typically have an entrepreneurial personality and share entrepreneurial values. Role models are pivotal in providing demonstration and peer effects. This implies that frequent social interaction with an entrepreneur can shape a person's perception and thinking about self-employment, as well as her or his entrepreneurial skills (Minniti 2005; Nanda and Sorensen 2010; Bosma et al. 2012). Such role model effects may occur at the regional level (Lafuente et al. 2007; Giannetti and Simono 2009; Andersson and Larsson 2016), at the level of universities and firms (Lerner and Malmendier 2013), and at the family level (Laspita et al. 2012; Lindquist et al. 2015; Vladasel et al. 2021). Since people typically start their firm close to where they reside (Stam 2007; Dahl and Sorenson 2012), such entrepreneurial role model effects are likely to be concentrated in the respective area and might not diffuse into other regions. Start-ups induced by role model effects lead to an increase of the number of role models and of the social acceptance of entrepreneurship that implies a self-perpetuation of entrepreneurship over time.

Based on these considerations and the previous literature, we expect that the larger the historical level of self-employment, the greater the spread of entrepreneurial attitudes and peer effects to the next generation. Therefore, we conjecture at the regional level:

> *H1a: The higher the regional self-employment rate in a certain period the higher the level of new business formation in later periods.*

4.2 Spreading of role model effects: Historical household size of entrepreneurs

It is a stylized fact of entrepreneurship research that a person is significantly more likely to select self-employment if her or his parents or grandparents were active as entrepreneurs (Laspita et al. 2012; Lindquist et al. 2015; Vladasel et al. 2021). There are two main explanations for such a relationship. First, the persistence of entrepreneurship may be based on a transfer of genetic dispositions from parents to their offspring that are conducive to entrepreneurial activity ('nature' as transfer channel).

Second, the way of breeding children, particularly the parenting style as well as demonstration and peer effects, can include the transfer of entrepreneurial values, attitudes, and knowledge (transfer by 'nurture'). In this way, the intergenerational spillover of entrepreneurship from parents to their offspring may be an important channel by which entrepreneurship is transferred across generations leading to the persistence of regional entrepreneurial culture. Although the details of these two ways of transfer are not entirely clear, empirical studies suggest that each of the two channels may roughly explain about 50% of the intergenerational transfer, so that both mechanisms are of about equal importance (Lindquist et al. 2015).

Regarding the genetic component of the intergenerational transfer of entrepreneurship (Abdellaoui et al. 2019; Vladasel et al. 2021), it is plausible to assume that it is directly proportional to the number of an entrepreneur's biological children. An effect of the nurturing component of intergenerational transfer requires close contact, which is likely to be in place when children and their parents live in the same household. The relationship of this nurturing effect with the number of children should also be positive, but may not be strictly proportional (Black et al. 2005). On the one hand, it may be less than proportional because parents are faced with a time constraint so that the breeding effort per child may decrease with their number. On the other hand, parental breeding may benefit from learning effects and scale economies. In addition, elder children can take over parts of the educational effort. Generally, also other family members living in the household such as grandparents may exert an influence on entrepreneurial intentions of the offspring (Laspita et al. 2012).[4] There might also be spillover effects of an entrepreneurial role model on further family members, for example, on spouses (e.g. Parker 2008) but also on other household members such as

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[4] The intergenerational transfer of entrepreneurship in terms of inheritance of the parent's firm to the children may be negatively related to the number of children if ownership is split among the children. The same should hold for the amount of resources that entrepreneurs are able to inherit to their children. It may, however, be well the case that this amount of resources is mainly related to the second transfer channel that we investigate here, namely the economic success of a regional entrepreneurs.

domestic servants, as the literature finds that entrepreneurial role modeling works well beyond the direct family context (e.g., Bosma et al. 2012).

Given the relevance of the family for the spread of entrepreneurial role models, it is plausible to assume that all household members of a self-employed person may be more or less 'infected' by the entrepreneurial role model, have a relatively high level of social acceptance of entrepreneurship, and also show a relatively high propensity for entrepreneurial behavior in later periods. Hence, the larger the size of entrepreneurial families, the larger also the number of potential role models in the future. We operationalize this assumption by calculating an *extended self-employment rate* that is the share of the regional population living in households of self-employed. Compared to the regular self-employment rate that is limited to the *direct* peer effect of an entrepreneur, the impact of the extended self-employment rate should be considerably stronger, as it also comprises the *indirect* effect via the members of the entrepreneurial households (household spreading effect).

> *H1b: The higher the extended regional self-employment rate (share of population living in households of self-employed) in a certain period the higher the level of new business formation in later periods.*

The regional impact of the household spreading effect may not only depend on the household size of self-employed but also on the household size of employees. If the households of employees in a region are larger compared to entrepreneurial households than their spreading effect may dominate eventually promoting a "culture of paid employment." We assume that a large household size of self-employed relative to the households of paid employees stimulates the regional level of entrepreneurship. Thus, we hypothesize:

> *H1c: The larger the household size of self-employed as compared to the households of paid employees, the higher the level of regional new business formation in later periods.*

4.3 Strengthening of role model effects: Economic success of regional entrepreneurship

The economic success of entrepreneurs can affect the emergence and persistence of a regional entrepreneurial culture in several ways. First, economically successful entrepreneurs are more likely to stay in business and

pass on their ventures to future generations. Second, successful entrepreneurs should be able to inherit more economic wealth to their offspring that could be conducive to setting up their own businesses. Third, the economic success of self-employed demonstrates that starting an own business can be a viable option, and hence generate particularly pronounced role model effects. Observing successful businesses provides potential entrepreneurs with examples of how to organize resources and activities and can increase their entrepreneurial self-efficacy (Bandura 2001; Newman et al. 2019). Hence, successful entrepreneurship may lead to an increase in regional self-employment and its success, thereby stimulating a regional entrepreneurial culture (Dunn and Holtz-Eakin 2000; Parker 2018). In this way, factual entrepreneurship creates a sort of perceptual nonpecuniary externality that spurs start-up activity and makes entrepreneurship self-reinforcing.[5] Fourth, successful entrepreneurship can stimulate a positive collective memory, a kind of positive intertemporal pecuniary spillover effect, which can stimulate start-ups in later periods.

For all these reasons, we expect that the greater the economic success of self-employed the higher the start-up rates in later periods and the more pronounced the persistence of entrepreneurship over time.

> *H2: The greater the economic success of entrepreneurship in a region, the higher regional start-up rates in later periods.*

There is evidence that successful role models are more important than less successful ones (e.g., Scherer et al. 1989; Dunn and Holtz-Eakin 2000; Abbasianchavari and Moritz 2021).[6] Against this background, it appears plausible to assume that the role model effects of historical entrepreneurship are larger for economically successful firms than for firms that perform only poorly. This is based on the observation that successful role models are more likely to be imitated than unsuccessful ones. This also matches previous

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[5] Fornahl (2007) describes how the example of a very successful super-star entrepreneur in the East German city of Jena in the 1990 and early 2000s stimulated new business formation in the region.

[6] Wyrwich et al., (2019) find this in the context of firm failure. Social contact with successful entrepreneurs reduces fear of failure while contact with failed entrepreneurs increases fear of failure preventing observers from starting a firm.

empirical evidence that indicated that persistence of entrepreneurship is stronger when historical entrepreneurship was more successful (Fritsch et al. 2019; 2022b). Therefore, the effect of the historical level of self-employment on the levels of new business formation in the succeeding periods should be related to the economic success of the entrepreneurial role model. This means that the effects described by hypotheses 1a-c might be reinforced by the success of regional entrepreneurship. Since the economic success of self-employment stimulates its social acceptance and therefore encourages more start-up activity in later periods, it is plausible to expect that a high level of self-employment, a high population share of entrepreneurs' household members (extended self-employment rate) and large entrepreneurial household size in relation to the household size of paid employees generate a stronger positive role model and spread effect if the self-employed in the region were on average more successful.

A further effect could be that successful role models are more likely to breed particularly successful entrepreneurs if there is a high share of local population with an entrepreneurial intention, as indicated by the extended self-employment rate and the relative household size. It may also be the case that economic success of entrepreneurs triggers a more pronounced positive collective memory of entrepreneurship in later periods if there are relatively many persons in the regional population who have an entrepreneurial mindset and good entrepreneurial abilities. Hence, we expect and test in our empirical analysis: [7]

> *H3a: There is a positive interaction effect between the regular self-employment rate and the success of self-employed on the formation of new regional businesses in later periods.*

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[7] It may also be the case that there is only one or that there are only some very few extremely successful 'superstar' entrepreneurs in the region that lead to a relatively high average income of the regional self-employed. In such a constellation the on average high economic success of regional self-employment may not lead to higher levels of new business formation in successive periods because the number of successful entrepreneurial role models in the region is rather few. It may, however also be the case that a single superstar entrepreneur generate particularly strong role model effects. See Fornahl (2007) for the detailed exposition of an empirical example

H3b: There is a positive interaction effect between the extended self-employment rate and the economic success of self-employed on the formation of new regional businesses in later periods.

H3c: There is a positive interaction effect between the relative household size of entrepreneurs and the success of self-employed on the formation of new regional businesses in later periods.

5. Empirical analysis

5.1 Data and estimation approach

The geographic framework of the empirical analysis are the 252 labor market regions (BBSR 2012), which represents functionally integrated spatial units with interwoven commuting patterns. This captures potential spatial spillover of role model effects. We have to exclude the city of Berlin because the data for East and West Berlin cannot be separated and the Saarland, for which there is no data for the year 1925 available because the regions was at that time under French administration. Hence, our analysis includes 199 regions in West Germany and 53 regions in the East.

The information on the self-employed and their household members in the year 1925 comes from the population census of that year (Statistisches Reichsamt 1927). Household members consist mainly of spouse, children, and grandparents.[8] Unfortunately, the available information does not allow us to disentangle these different types of household members. It is, however, plausible to assume that differences in the number of household members mainly reflect the number of children and can, therefore, be used as a proxy for the number of offspring that a self-employed person has.

Our main variable of interest for testing H1a is the regional self-employment rate which is the number of self-employed over the total regional workforce in percent. The main variable for testing H1b is the extended self-employment rate, i.e., the number of self-employed and their household members over the total regional workforce in percent. We use the size of the

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[8] It also includes servants in few cases. Servants are not included in the data if they do not live in the household.

regional entrepreneurs' households relative to the household size of dependent employees for testing H1c.

It is important to note that the historical self-employment rate captures the nucleus of role model effects in later periods, indicating the scope of the self-perpetuation process of an entrepreneurial culture described in Section 4. The more role models there existed in 1925 the stronger the effect on role models and social acceptance of entrepreneurship in the next generation, which, in turn, positively affects entrepreneurship in subsequent generations. It is important to note that testing H1a-c does not require direct social contact between role models and future entrepreneurs. We take the year 1925 only as the starting point for a dynamic process of role modeling affecting entrepreneurship in the future, as described, for example, in the model by Minniti (2005).

Information about the economic success of self-employed persons comes from tax statistics for the year 1925 (Statistisches Reichsamt 1929). Our variable for testing H2 is the average taxable income per self-employed in a region. We assume that the income of self-employed stems mainly from their entrepreneurial activity. Unfortunately, our information is limited to the average taxable income of the regional self-employed, whereas the distribution of incomes among this group is unknown. Hence, we cannot say to what extent a high average income from self-employment in a region represents a broad tendency or is shaped by one or a few outliers who have extremely high incomes. For testing H3a-c, we interact the average taxable income per self-employed in a region with the regular self-employment rate (test of H3a), the extended self-employment rate (test of H3b), and the relative household size of entrepreneurs (test of H3c).

We analyze how historical data on self-employment link to current levels of start-up rates. The start-up rate is defined as the number of newly registered businesses (excluding agriculture) in the workforce. Data on start-up activity are obtained from the Establishment History Panel of the German employment statistics (Ganzer et al. 2021). For West Germany, these data are available for the period 1976 to 2020. The time series for East Germany begins in the mid-1990s. Because of the longer time series of available data,

we conduct our main analysis for West Germany and consider the East German data in a robustness check to understand whether the results are stable in this specific context, which saw much more radical shocks than West Germany.

In our analysis, we control for historical industry structure (employment shares of manufacturing, construction, and mining), population density, as well as geographic distance to historical centers of knowledge production as indicated by the nearest classical and technical university in the year 1900.[9] We also include the number of employees in the observation year to rule out that the results for the start-up rate are driven by a change of employment over time, as employees are the denominator of the start-up rate. All of the mentioned control variables as well as the main independent variables are continuous and log-transformed. Furthermore, we include year fixed effects to account for time trends while Federal State dummies control for different (entrepreneurship relevant) policies as well as for unobserved heterogeneity and spillover of role model effects across Federal States. Table A1 in the Appendix shows the definition of the main variables used in the analyses.

Table 1 presents summary statistics for West German regions, and Table A2 in the Appendix shows the correlation matrix. Tables A3 and A4 in the Appendix display summary statistics and the correlation matrix for East Germany that we consider in the robustness checks. Table 1 provides several interesting descriptive insights. The average regular self-employment rate in 1925 was about 7.8 percent, while the extended rate that includes the household members of entrepreneurs was about 10 percent. The coefficient for the relative household size of self-employed 1925 has a value of about 1.46 indicating that the households of self-employed are on average larger than those of dependent employees. The average start-up rate in the period 1976-2020 is about 34 start-ups per 10,000 employees. All these indicators show a considerable degree of variation across regions.

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[9] See Fritsch and Wyrwich (2019) for a more detailed exposition of this variable.

Table 1: Summary statistics West Germany

	Mean	Standard Deviation	Minimum	Maximum
Start-up rate 1978-2020	33.58	12.8	7.92	99.99
Self-employment rate 1976-2020	6.39	1.18	2.3	12.25
Population share of self-employed 1925 (regular self-employment rate)	7.8	1.62	4.84	12.25
Population share of self-employed and their household members 1925 (extended self-employment rate)	9.96	1.67	6.31	14.37
Relative household size of self-employed 1925	1.46	0.12	1.25	1.87
Average income of self-employed 1925	2.7	0.63	1.29	4.39
Employment share manufacturing 1925	24.24	11.39	7.19	58.72
Employment share mining 1925	1.75	4.68	0.1	43.48
Employment share construction 1925	4.47	1.18	1.94	7.99
Population density 1925	4.77	0.81	3.49	7.84
Distance to the nearest classical university founded before 1900	68.77	36.53	0	168.81
Distance to the nearest technical university founded before 1900	96.54	48.8	0	254.49
Number of employees (t-1)	119,144.53	173,148.46	11,797	1.67E+06

5.2 Multivariate analysis: Main results

The models in Table 2 show the main results of our analysis. We find that the historical self-employment rate, the relative household size of self-employed as well as the average income of the regional self-employed are positively related to start-up rates in the period 1978-2020 (column I). This is consistent with Hypotheses 1a, 1b, and 2. The model shown in column II), we use the extended self-employment rate. The coefficient estimate for the extended self-employment rate is somewhat larger than for the regular self-employment rate. The effect for the average income of the self-employed in 1925 is significant and twice as large as compared to column I. This difference in the coefficient estimate indicates that it matters whether one measures the role of self-employed and the number of household members separately or not. One potential explanation for this result is that there are meaningful interaction effects of these variables with the income variable, which would be in line with some of our hypotheses.

Table 2: Main results for West Germany

	(I)	(II)	(III)	(IV)
	Start-up rate (ln)			
	Test H1a/c & H2	Test H1b & H2	Test H3a/c	Test H3b
Population share of self-employed 1925 (regular self-employment rate)	0.312*** (0.018)		0.199*** (0.061)	
Relative household size of self-employed 1925	0.750*** (0.033)		-0.327** (0.159)	
Average income of self-employed 1925	0.112*** (0.018)	0.202*** (0.018)	-0.545*** (0.136)	0.132 (0.173)
Regular self-employment rate X average income of self-employed 1925			0.115** (0.051)	
Relative household size of self-employed 1925 X average income of self-employed 1925			1.085*** (0.153)	
Population share of self-employed and household members 1925 (extended self-employment rate)		0.402*** (0.022)		0.371*** (0.089)
Extended self-employment rate X average income of self-employed 1925				0.031 (0.077)
Controls	Yes***	Yes***	Yes***	Yes***
Constant	3.775*** (0.068)	3.740*** (0.077)	4.342*** (0.175)	3.811*** (0.229)
R^2	0.769	0.762	0.771	0.762

Notes: N=8,557: Robust standard errors in parentheses (clustered at the state-x-year-level). *** $p<0.01$, ** $p<0.05$, * $p<0.1$. We control historical industry structure (employment share of manufacturing, construction, and mining), population density, and distance to historical centers of knowledge production (classical and technical universities in 1900). We also include the number of employees. All of these variables as well as the main independent variables are continuous and log-transformed. Furthermore, we include year and state fixed effects.

For testing Hypotheses 3a and 3b directly, we interact the average income of self-employed in 1925 each with the regular self-employment rate (H3a) and the relative household size of entrepreneurs (H3c) (column 3). In accordance with Hypotheses 3a and 3c the estimated coefficients for the interaction effects are statistically significant with a positive sign. As the interaction term is based on two continuous variables, the coefficient estimates in Table 2 are not meaningful. Therefore, Figures 1a and 1b illustrate the effect of the economic success of historical entrepreneurship on start-up activity at different levels of the regular self-employment rate and different levels of the historical household size of the self-employed. There is no significant interaction effect between the extended self-employment rate

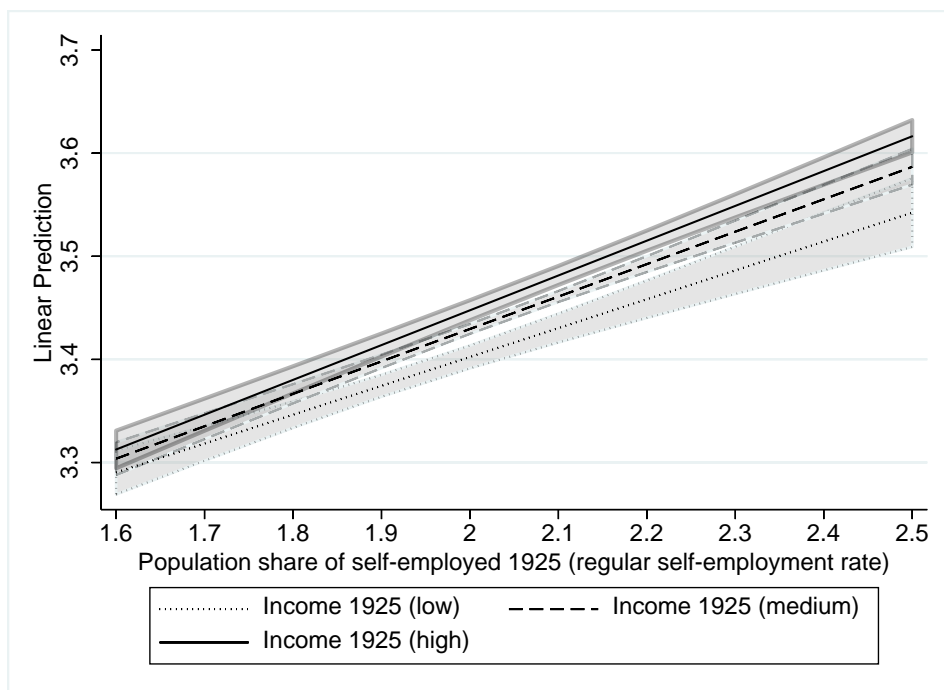Figure 1a: Predictive margins of the average income of self-employed in 1925 at different levels of the regular self-employment rate[10]
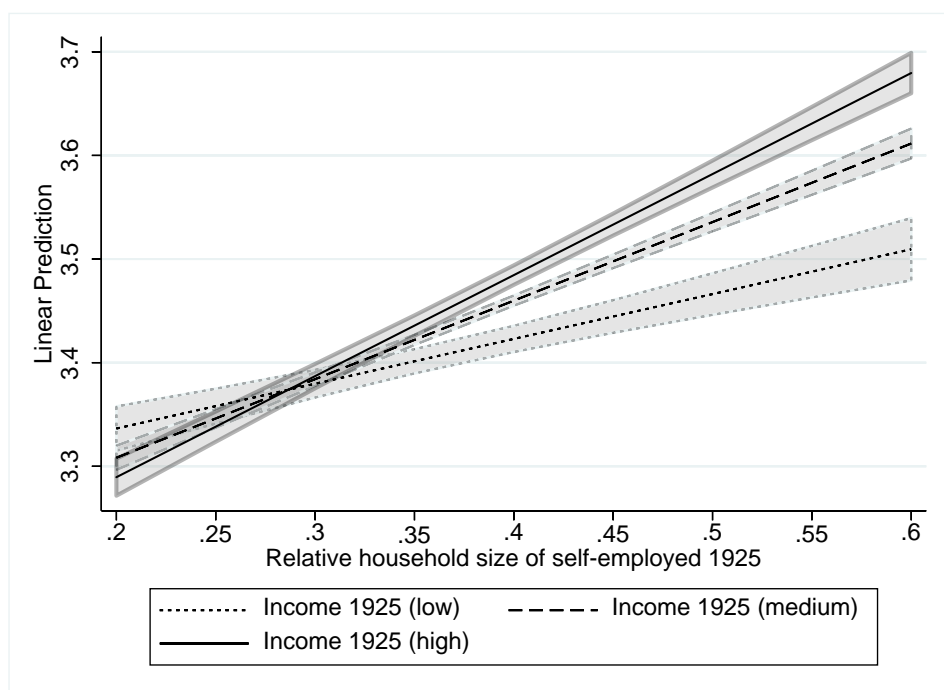

Figure 1b: Predictive margins of the average income of self-employed in 1925 at different levels of relative household size of self-employed

[10] Medium income reflects the mean income in 1925 while low/high represent a negative/positive one standard deviation from the mean value.

and the historical success of entrepreneurs (column IV of Table 2). This suggests that combining the effects of role models and their household members in one measure masks potential interaction effects with historical income.

We conducted several robustness checks. First, we ran the models using the self-employment rate in the period 1996-2020 instead of the start-up rate as the dependent variable.[11] The self-employment rate represents the stock of past start-ups and their survival. The results resemble the main analysis (Table A6 in the Appendix). The same applies when adding control variables that account for contemporaneous regional development (Table A7 in the Appendix). These variables were the annual changes of population, employment, and of the share of engineers and natural scientists (for definitions, see Table A1 in the Appendix). We also analyzed the effect of the main explanatory variables in separate models. This exercise yielded significant estimates (Table A8 in the Appendix).[12]

5.3 Exploring the effects of historical household size and entrepreneurial success over time and across institutional contexts

We also explore whether the impact of historical self-employment and its success varies over time. To this end, we interact the historical measures with year dummies. Calculating year-specific effects also assuages concerns that our main findings are driven by pooling observations of the dependent variable from multiple years.

In Table 3, we present a simplified version of these models where we interact the historical measures only with a cohort dummy variable *Year2000+* indicating years in the 21st century vs. the 20th century (column 1). The results show that from the year 2000 onwards the impact of historical household size is significantly lower while the impact of the regular self-

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[11] Data on self-employment is obtained from the Federal German Statistical Office (*Statistische Ämter des Bundes und der Länder, Arbeitskreis Erwerbstätigenrechnung*).

[12] It is remarkable that the coefficient estimate for the average income (Table A8, column III) is almost eight times larger as compared to the main model where all main variable of interest are introduced jointly (Table 2, column I). This suggests that the effect of the entrepreneurial income is partly mediated by the presence of entrepreneurial role models.

Table 3: The impact of historical self-employment over time

	(I)	(II)	(III)	(IV)
	Start-up rate (ln)			
Year2000+ (dummy, yes=1)	-0.787***	-1.064***	-0.604*	-0.768*
	(0.099)	(0.139)	(0.309)	(0.450)
Population share of self-employed 1925 (regular self-employment rate)	0.248***		0.222***	
	(0.025)		(0.081)	
Average income of self-employed 1925	0.033	0.117***	-0.524***	0.154
	(0.026)	(0.027)	(0.191)	(0.229)
Year2000+ (dummy, yes=1) X regular self-employment rate	0.126***		-0.082	
	(0.037)		(0.131)	
Relative household size of self-employed 1925	1.025***		-0.274	
	(0.069)		(0.305)	
Year2000+ (dummy, yes=1) X relative household size of self-employed 1925	-0.573***		0.047	
	(0.117)		(0.458)	
Year2000+ (dummy, yes=1) X average income of self-employed 1925	0.205***	0.220***	0.007	-0.081
	(0.039)	(0.037)	(0.289)	(0.371)
Population share of self-employed and household members 1925 (extended self-employment rate)		0.329***		0.343***
		(0.035)		(0.115)
Year2000+ (dummy, yes=1) X extended self-employment rate		0.134**		0.003
		(0.053)		(0.192)
Average income of self-employed 1925 X regular self-employment rate 1925			0.027	
			(0.070)	
Year2000+ (dummy, yes=1) X average income of self-employed 1925 X regular self-employment rate 1925			0.209*	
			(0.115)	
Average income of self-employed 1925 X relative household size of self-employed 1925			1.297***	
			(0.266)	
Year2000+ (dummy, yes=1) X average income of self-employed 1925 X relative household size of self-employed 1925			-0.595	
			(0.382)	
Average income of self-employed 1925 X extended self-employment rate 1925				-0.016
				(0.099)
Year2000+ (dummy, yes=1) X average income of self-employed 1925 X extended self-employment rate 1925				0.133
				(0.158)
Controls	Yes***	Yes***	Yes***	Yes***
Constant	4.071***	4.204***	4.551***	4.172***
	(0.082)	(0.102)	(0.228)	(0.292)
R^2	0.606	0.594	0.608	0.594

Notes: N=8,557: Robust standard errors in parentheses (clustered at the state-x-year-level). *** $p<0.01$, ** $p<0.05$, * $p<0.1$. We control historical industry structure (employment share of manufacturing, construction, and mining), population density, and distance to historical centers of knowledge production (classical and technical universities in 1900). We also include the number of employees. All of these variables as well as the main independent variables are continuous and log-transformed. Furthermore, we include year and state fixed effects.

employment rate and the historical success of self-employment is larger.

There are no significant period-specific effects for the interaction terms with

historical success of entrepreneurship (column II). The effect of the extended

self-employment rate is also significantly stronger in the 21st century (column II) while there is no cohort-specific interaction effect (column IV).

In Figure 2, we show the predictive margins for the regular historical self-employment rate, the relative size of self-employed, and the success of historical entrepreneurship on the formation of new businesses in later time periods based on a model in which these variables are interacted with dummy variables for every year.[13] According to the results from the simplified version shown in Table 3, the impact of the historical size of the household and historical income of entrepreneurs is significantly lower, while the impact of the regular self-employment rate and the historical success of self-employment is greater in the years of the 21st century. There are no significant year-specific coefficient estimates for the interaction terms with the historical success of entrepreneurship (see Figure A1).
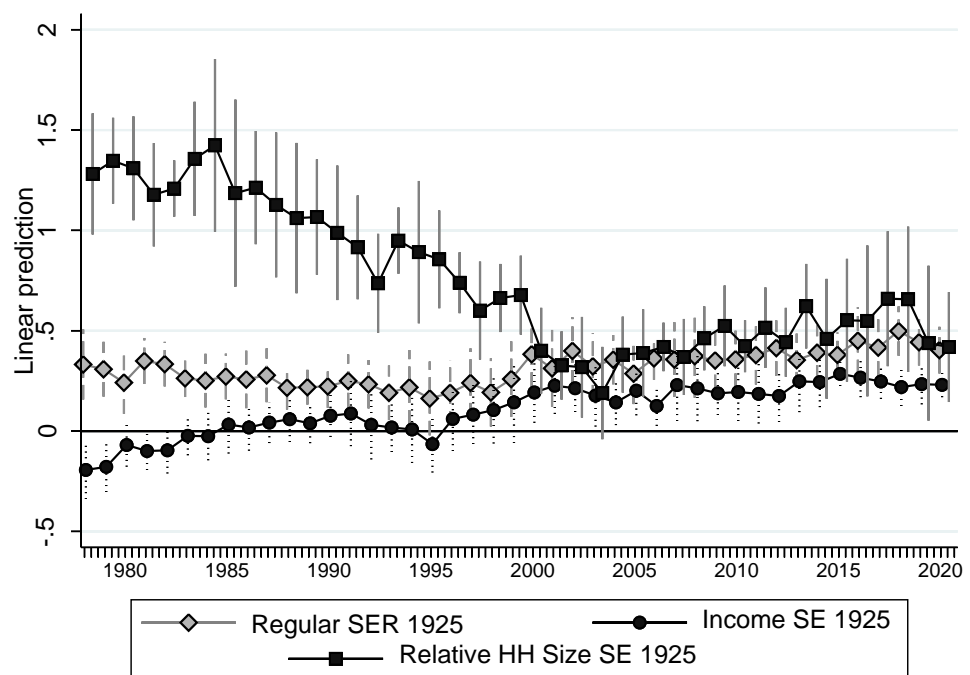
Figure 2: Predictive margins (with 95% confidence intervals) of historical level (*regular self-employment rate, SER 1925*), relative household size of self-employed (*relative HH Size SE 1925*), and success of self-employment (*income SE 1925*) over time (model I, Table 3)

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[13] As there are 40 year dummies the model underlying Figure 2 includes 80 two-way and 80 three-way interaction terms. Hence, the respective regression table includes more than 200 variables for capturing the interaction. Thus, presenting the results in a figure is more convenient than the table.

The increase in effect size for the regular self-employment rate and the historical success of entrepreneurship after a period of 75 years is quite remarkable, suggesting that certain factors or events may have activated and reinforced this collective memory.[14] We can only speculate about the factors or events that had this effect. One such event could be a shift from a 'managed' towards a more 'entrepreneurial' society, which is said to have occurred during the 1970s and onward (Audretsch 2007). Throughout this process, the role of entrepreneurship in the economy increased and became more popular in the media and in everyday life. This development may have shaped the awareness of the local population about the existence of a regional tradition of successful entrepreneurs that could be perceived as historic role models. This could also be promoted by local awareness campaigns that highlighted the historical success of entrepreneurship in the region. At the same time, the impact of the relative household size decreases over time, suggesting that the indirect spreading effect of historical role models becomes weaker and that collective memory is mainly directly linked to historical role models.

Finally, we analyze whether the relationships we found also hold in a considerably different institutional context.[15] To this end, we run the analysis for the Eastern German regions. East Germany provides us with an opportunity to test whether the results are still significant under considerably more extreme conditions (see Section 2). The introduction of a socialist regime in East Germany after WWII led to a sharp decline in self-employment there. In particular, the socialist regime was marked by anti-capitalist rhetoric and anti-entrepreneurial policies aimed at breaking up family traditions in self-employment (e.g., Pickel 1992). These policies should have severely weakened or even completely disrupted the intra-family transmission of entrepreneurial values and abilities, as the household members of the few remaining self-employed in the GDR had hardly any chance to start own ventures and to disseminate an entrepreneurial culture. At

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[14] For a discussion of cases where historical memory was activated by later events see Ochsner and Roesel (2017) and Fouka and Voth (2022).

[15] On average, the start-up rates in East Germany was slightly lower over the whole observation period (see Table A4 in comparison to Table 1).

the same time, there were pronounced regional differences in self-employment in the GDR that reflected the remains of an entrepreneurial culture from the period before WWII (Wyrwich 2012). Furthermore, collective memory about successful pre-socialist entrepreneurship should have been significantly hampered due to intensive propaganda against entrepreneurs and the entrepreneurial role model.

The communist experience and the radical transition shock after 1990 are deeply manifested in the collective memory of the East German population (Mau 2019), eventually overshadowing earlier historical developments and traditions such as a prevalence of high levels of entrepreneurship. Apart from that, many successful entrepreneurs migrated to West Germany after World War II in order to avoid expropriation. As a consequence, historical role models in East German regions may have induced lower levels of collective memory than historical self-employment in West Germany where such an exodus of entrepreneurial talent did not occur. For these reasons, one could expect that the effect of historical household size and historical success on current levels of entrepreneurial activity in East Germany is lower than what we found for West Germany.

We conducted a comparative analysis of the effect of historical entrepreneurship on new business formation in East and in West Germany in the period 2000–2020 (Table 4). Years before 2000 were excluded to avoid a strong impact of the East German transition on start-up activity. It is rather remarkable that the coefficient for the interaction term between a dummy indicating an East German region and the regular historical self-employment rate is statistically significant with a positive sign (column 1). This indicates that the effect of the regional self-employment level in the year 1925 on the current level of new business formation is stronger in East Germany than in the West. The coefficient for the interaction of the extended historical self-employment rate with the dummy for East Germany is also statistically significant with a positive sign (column II).

Table 4: Joint analysis for East and West Germany (period 2000-2020)

	(1)	(2)	(3)	(4)
	Start-up rate (ln)			
East (dummy, yes=1)	0.077	-0.144	0.920	1.469
	(0.195)	(0.221)	(0.656)	(0.916)
Population share of self-employed 1925 (regular self-employment rate)	0.300***		0.134	
	(0.028)		(0.098)	
Relative household size of self-employed 1925	0.509***		-0.513***	
	(0.030)		(0.151)	
Average income of self-employed 1925	0.098***	0.154***	-0.642***	-0.003
	(0.028)	(0.029)	(0.185)	(0.226)
Population share of self-employed and household members 1925 (extended self-employment rate)		0.368***		0.298**
		(0.031)		(0.124)
East (dummy, yes=1) X regular self-employment rate 1925	0.292***		-0.044	
	(0.055)		(0.324)	
East (dummy, yes=1) X relative household size of self-employed 1925	-0.205**		-0.994*	
	(0.085)		(0.556)	
East (dummy, yes=1) X average income of self-employed 1925	-0.060	-0.103**	-0.891	-1.644**
	(0.048)	(0.050)	(0.565)	(0.830)
East (dummy, yes=1) X extended Self-employment rate 1925		0.243***		-0.534
		(0.064)		(0.420)
Regular self-employment rate 1925 X average income of self-employed 1925			0.167**	
			(0.081)	
Relative household size of self-employed 1925 X average income of self-employed 1925			1.033***	
			(0.154)	
Extended self-employment rate 1925 X Average income of self-employed 1925				0.069
				(0.106)
East (dummy, yes=1) X Average income of self-employed 1925 X regular self-employment rate 1925			0.274	
			(0.278)	
East (dummy, yes=1) X average income of self-employed 1925 X relative household size of self-employed 1925			0.879	
			(0.598)	
East (dummy, yes=1) X average income of self-employed 1925 X extended self-employment rate 1925				0.673*
				(0.353)
Controls	Yes***	Yes***	Yes***	Yes***
Constant	3.109***	3.012***	3.761***	3.171***
	(0.080)	(0.093)	(0.236)	(0.302)
R²	0.699	0.695	0.701	0.695

Notes: N=5,292: Robust standard errors in parentheses (clustered at the state-x-year-level). *** p<0.01, ** p<0.05, * p<0.1. We control for historical industry structure (employment share of manufacturing, construction, and mining), population density, and distance to historical centers of knowledge production (classical and technical universities in 1900). We also include the number of employees. All of these variables as well as the main independent variables are continuous and log-transformed. Furthermore, we include year and state fixed effects. The East dummy cannot be interpreted in a meaningful way due to inclusion of state-fixed effects.

There is a negative coefficient for the interaction of relative household size of the self-employed with the East Germany dummy. This result implies a lower positive overall effect of relative household size of self-employed across East German regions. This result is plausible given that household members of the self-employed could hardly start own firms during the rigid anti-entrepreneurial communist regime, so that there was also no room for indirect spreading effects emerging from historical role models.

A potential explanation for the much stronger effect of historical self-employment on current levels of new business formation in East Germany could be the turmoil of the transition process that created severe challenges but also provided relatively many significant entrepreneurial opportunities. These developments may have triggered a collective memory about historical entrepreneurship while structural determinants of start-up activity were much less important as compared to the well-established West German economy.[16]

There is no differential effect of the economic success of historical entrepreneurship, that is, successful historical entrepreneurship affects current levels of new business formation in East Germany to the same degree as in West Germany. In the case of East Germany, this finding can hardly be explained by continuing activity of East German entrepreneurs or their offspring, because the socialist government expropriated most private firms and did not allow them to set up new ones. Moreover, many of the successful East German entrepreneurs migrated to West Germany after WWII. Therefore, our finding of a similar effect on the success of historic entrepreneurship in East and West suggests a main role of collective memory rather than persistent activity of successful entrepreneurial families.

Finally, there is no East-West difference with respect to the interaction effect between historical success of entrepreneurship and the other historical entrepreneurship measures (columns III and IV in Table 4). Altogether, extending the analysis to East Germany reveals that there is also an effect of

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[16] The historical control variables often have opposing signs for East and West Germany partly reflecting that the development of regional economic structures was quite different since WWII.

levels and economic success of historical entrepreneurship in very different contexts.

6. Discussion

6.1 Contribution to the literature

Our analysis clearly demonstrates the relevance of two channels for the transfer of regional entrepreneurship over long periods of time: role-model effects, as well as a collective memory of historic entrepreneurship. We assume that these transfer channels are linked to the historic self-employment rate, the relative size of the historic entrepreneurial households, and the economic success of these historic entrepreneurs. Although the self-employment rate indicates direct role model effects of regional entrepreneurs, the size of entrepreneurial households reflects the scope of intergenerational transmission of entrepreneurial activity that may be based on transfer of entrepreneurship within the family and be particularly related to the number of children. We further assume that the economic success of historic entrepreneurs, as indicated by their taxable income, may spur their role-model effects as well as a collective memory of the contribution of historical entrepreneurship to regional wealth.

Our approach and the empirical analyses contribute to several fields of literature. First, we combine the important role of social contact at the local level (e.g., Andersson and Larsson, 2016; Sorenson, 2017) and within the family (Laspita et al. 2012; Lindquist et al. 2015; Vladasel et al. 2021) for the effectiveness of entrepreneurial role models. Our results reveal that both, regional levels of historic entrepreneurship and the size of entrepreneurial households play an important role in the long-term transmission of regional entrepreneurship. We also apply the theory of collective memory of places (Olick et al. 2011) to the context of entrepreneurship and show that this can explain regional differences in start-up activity. Our assessment of the historical level and success of entrepreneurship as the size of the well as entrepreneurial household shows that they are important formative factors in a regional entrepreneurship culture. Therefore, our work adds to the literature on understanding the roots and elements of a regional entrepreneurship

culture (e.g., Mueller and Thomas 2001; Stuetzer et al. 2016; Fritsch and Wyrwich 2019). We also find a pronounced interaction effect between historical success of entrepreneurship and the historical self-employment rate as well as with entrepreneurial household size, indicating that both factors are reinforcing each other. This adds to our understanding of how the different elements of a regional entrepreneurship culture are intertwined. In a similar vein, we contribute to the literature explaining the persistence of entrepreneurship (e.g., Andersson and Koster 2011; Fritsch and Wyrwich 2014; Opper and Andersson 2019; Novosák et al. 2022) by highlighting two transferchannels that were largely explored.

Moreover, by focusing on the size of entrepreneurial households for indirect local spillovers of entrepreneurial activity, we add to the literature on role model effects in entrepreneurship. Our empirical analysis demonstrates the importance of such long-term indirect effects at the local level due to transmissions within the family.

We also explored the effects of self-employment, historical household size, and entrepreneurial success over time and institutionally very different environments (East and West Germany) acknowledging the important role of context (e.g., Bird and Page West 1998; Johnsen and Holt 2023; Patriotta and Siegel 2019; Baker and Welter 2020). Interestingly, we find that the impact of successful historical entrepreneurship is increasing over time. This suggests that the collective memory of entrepreneurship was activated by certain events a. Such an event may have been a general shift to a more entrepreneurial society or the breakdown of the communist regime and the transformation to a market economic system in East Germany. This finding corresponds with recent literature finding that events and recent developments can reactivate history via a collective memory (Ochsner and Roesel 2017; Fouka and Voth 2022).

Running the empirical analyses separately for West Germany and for post-communist East Germany we found some important differences. In contrast to the analysis for West German regions there is no significant effect of household size of entrepreneurs in the year 1925 on new business formation in East Germany more than 75 years later. This corresponds to the

radical anti-entrepreneurship policy in the communist period that left hardly any opportunity for an entrepreneur's children to set up new businesses. At the same time, the regular self-employment rate has a stronger effect in East Germany whereas the success of historical entrepreneurship plays a similarly important role like in West Germany.

The East-West differences we detect suggest that context matters for understanding the elements and roots of entrepreneurship culture. Our additional assessment of East Germany also contributes to our knowledge about entrepreneurship in transition contexts (e.g., McMillan and Woodruff 2002; Kshetri 2009; Fritsch et al. 2022a; Sorgner and Wyrwich 2022). More precisely, we show ways by which regional factors that originate in pre-communist times can affect entrepreneurship today. This is in contrast to most parts of the transition literature that focuses heavily on the institutional legacies of communism (e.g., Aidis et al. 2008; Zhou 2017; Tran 2019), while pre-communist origins are often neglected.

6.2 Implications

The pronounced effects of historical entrepreneurial activity in a region on today's level of new business formation in this region strongly indicate the role of region-specific factors. Hence, any approach to explain regional entrepreneurial activity as well as any policy that is directed to entrepreneurship should account for factors at the regional level. Furthermore, our results strongly suggest that theory as well as entrepreneurship policies should account for historical developments and cultures. For example, in regions that have a tradition of successful entrepreneurship, developing awareness campaigns to reactivate and promote the collective memory of this successful past could be a promising option to foster regional self-employment. Regions that lack a successful entrepreneurial past may require different measures that should be tailored to their specific characteristics.

6.3 Avenues for further research

We applied available data for self-employment, the family size of self-employed and paid employees and on the average economic success in terms of taxable income of regional self-employed in the year 1925 to analyze two

channels by which self-employment in a region is passed on over long periods of time. These channels are the intergenerational transfer of the entrepreneurial role model and a collective memory of regional entrepreneurship. Although we found compelling evidence for the relevance of both channels as well as a significant role of family size and the economic success of local entrepreneurship in the transfer of entrepreneurship via these channels, further investigation of with better suited data may lead to further important insights. For example, it may be worth investigating the role of different types of historical self-employment (e.g., solo self-employed vs. employers) or self-employment in different sectors (e.g., agriculture vs. services vs. manufacturing), industries, or type of firms (e.g., innovative vs. non-innovative businesses).

Having shown a role for the average economic success of the self-employed in a region, we know almost nothing about the mechanisms by which the success of historical entrepreneurs drives persistence. Is it mainly the presence of successful 'superstars' that generates such an effect or is it more a broad regional trend of entrepreneurial success without such successful firms? Do, for example, successful historical firms have a relatively strong effect on a collective memory of historical entrepreneurship due to relatively high visibility? Does the success of historical entrepreneurs lead to greater entrepreneurial self-efficacy in the regional population? What is more important for persistence, success in terms of profits and income, or success in terms of venture growth and job creation?

At the same time, a venture growing to an extent that it becomes a large-scale or even a dominant local employer may also have a reverse effect on the local level of new business formation. This conjecture is based on the observation that a local environment of large-scale firms tends to be not conducive to new business formation (Sternberg 2009).

More fine-grained data for different points in time are desirable to gain a better understanding of the mechanisms that are relevant in the long-term transfer and development of regional entrepreneurship. Furthermore, it is important to understand why there were regional differences in the level and success of historical entrepreneurship in the first place. What is the role of

geography and historical developments in shaping historical entrepreneurship? What kinds of event led to the emergence of a certain culture that is conducive or not to entrepreneurship? What other elements of a local culture matter? Do inheritance practices play a role? It is also crucial to explore the factors that determine the strength of collective memory of entrepreneurship across regions. What is the role of education level, experienced interregional mobility (e.g., forced migration), social status, or economic situation (e.g., unemployment) of the local population in this regard? What kind of events can activate a collective memory (by whom)?

It is also important to understand whether the relationships found in our analysis hold in other countries and contexts. Moreover, the role of local policies in shaping historical entrepreneurship deserves further exploration. Were there specific entrepreneurship-supporting policies such as the introduction of favorable institutional framework conditions that had a long-run effect?

Finally, it is worth investigating outlier regions. For example, regions with high levels of historically successful entrepreneurship with low entrepreneurship rates today and vice versa. What are the specific moderation factors that hinder the links we found in our paper and explain such outliers? There are certainly several other avenues for future research, and our results encourage further investigation.

7. Conclusions

There is mounting empirical evidence indicating that regional differences in entrepreneurship are highly persistent over time (Fritsch and Wyrwich 2023). While the finding clearly suggests the impact of an enduring entrepreneurial culture, the underlying channels through which such a culture affects entrepreneurship are largely unknown. In this paper, we clearly demonstrate that within household transmission of entrepreneurial values and the historical success of entrepreneurship are two important channels behind the persistence of entrepreneurship. We also observe that the effect of both factors becomes stronger over time, suggesting a reactivation of collective

memory of entrepreneurship as the society and economy became more entrepreneurial over time.

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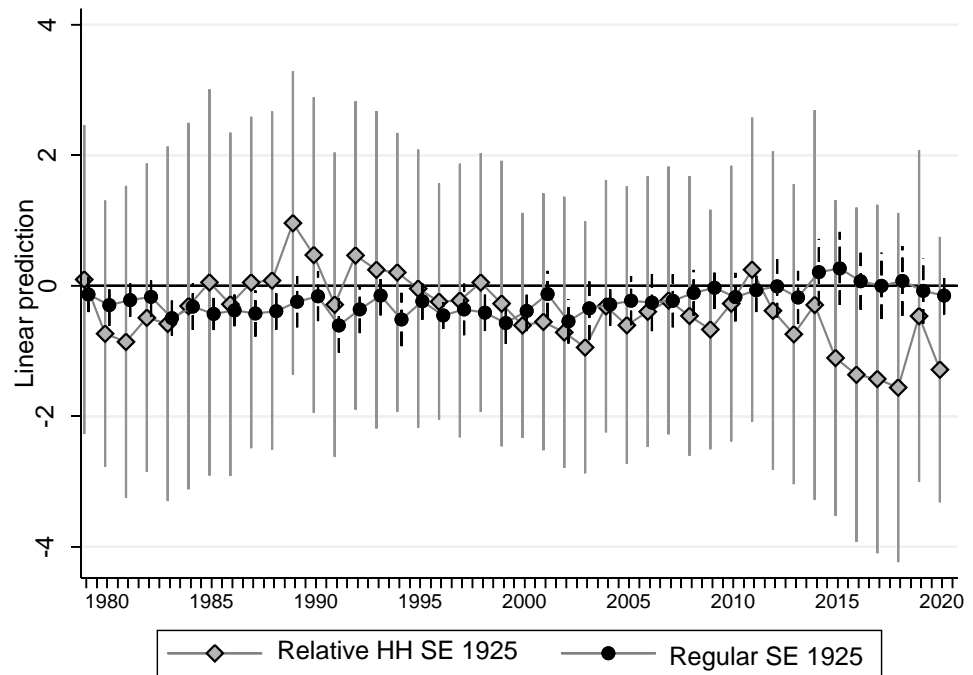
Appendix

Figure A1: Coefficients of interaction effects (reference year: 1978) of historical level and relative household size of self-employed with success of self-employment over time in West Germany (model 3, Table 3)

Table A1: Definition of variables

Variable name	Definition	Data source
• *Dependent variables*		
Start-up rate	Number of start-ups over number of employees in year t (1976-2020)	Establishment History Panel
Self-employment rate	Number of estalishments over number of employees in year t (1976-2020)	Establishment History Panel
• *Independent Variables*		
Population share of self-employed 1925 (regular self-employment rate)	Number of self-employed over total regional workforce in percent	Population Census 1925
Population share of self-employed and household members 1925 (extended self-employment rate)	Number of self-employed and her household members (helping family members and non-working) over total regional population in percent	Population Census 1925
Relative household size of entrepreneurs 1925	Size of household of self-employed relative to the size of households of dependent employees	Population Census 1925
Average income of self-employed 1925	Income in 1000 Reichsmark over total number of self-employed	Tax statistics 1925
• *Control variables*		
Employment share manufacturing 1925	Number of employees in manufacturing industries over total regional employment	Establishment History Panel
Employment share construction 1925	Number of employees in construction sector over total regional employment	Establishment History Panel
Employment share mining 1925	Number of employees in mining over total regional employment	Establishment History Panel
Population density 1925	Number of residents over size in square kilometers	Establishment History Panel
Distance to the nearest technical university 1900	Distance in km's	Own calculations
Distance to the nearest classical university 1900	Distance in km's	Own calculations
Number of employees	Number of employees in year t-1 (1976-2020)	Establishment History Panel
Annual population change	Annual change in population between t and t-1 (1976-2020)	Federal Statistical Office
Annual employment growth	Annual change in employment between t and t-1 (1976-2020)	Establishment History Panel
Annual change of employment share of engineers and natural scientists	Annual change in the employment share of people working as engineers or natural scientist between t and t-1 (1976-2020)	Establishment History Panel

Notes: The population census as of 1925 does not make a distinction between helping family members working for homeworkers. Homeworkers are not regarded as self-employed. In order to retrieve a number of helping family members that are linked to the self-employed, we multiply the number of helping family members with the number of self-employed over the total sum of self-employed and home workers. We use this adjusted number for constructing the extended self-employment rate and the relative household size of entrepreneurs. The underlying assumption of this procedure is that the number of helping family members in businesses of self-employed and within home worker households is similar.

Table A2: Correlation matrix West Germany

		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
1	Start-up rate 1978-2020	1											
2	Self-employment rate	0.222	1										
		[0.000]											
3	Population share of self-employed 1925 (regular self-employment rate)	0.093	-0.072	1									
		[0.000]	[0.000]										
4	Population share of self-employed and household members 1925 (extended self-employment rate)	0.113	0.036	0.944	1								
		[0.000]	[0.001]	[0.000]									
5	Relative household size of entrepreneurs 1925	-0.005	0.203	-0.258	-0.051	1							
		[0.654]	[0.000]	[0.000]	[0.000]								
6	Average income of self-employed 1925	-0.015	-0.309	0.408	0.312	0.005	1						
		[0.161]	[0.000]	[0.000]	[0.000]	[0.638]							
7	Employment share manufacturing 1925	-0.089	-0.319	0.54	0.483	-0.021	0.601	1					
		[0.000]	[0.000]	[0.000]	[0.000]	[0.049]	[0.000]						
8	Employment share mining 1925	0.053	-0.042	-0.031	-0.118	-0.363	0.16	0.054	1				
		[0.000]	[0.000]	[0.004]	[0.000]	[0.000]	[0.000]	[0.000]					
9	Employment share construction 1925	0.08	-0.11	0.618	0.507	-0.376	0.437	0.424	0.376	1			
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]				
10	Population density 1925	-0.028	-0.368	0.487	0.347	-0.292	0.619	0.685	0.198	0.403	1		
		[0.009]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]			
11	Distance to classical university founded before 1900	0.041	0.142	-0.131	-0.08	0.063	-0.162	-0.186	0.048	-0.173	-0.149	1	
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]		
12	Distance to technical university founded before 1900	-0.024	0.155	-0.255	-0.192	0.147	-0.189	-0.229	-0.029	-0.181	-0.252	0.085	1
		[0.026]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.007]	[0.000]	[0.000]	[0.000]	
13	Number of employees (t-1)	-0.208	-0.387	0.393	0.268	-0.128	0.615	0.489	0.102	0.384	0.612	-0.319	-0.342
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

Notes: p-value in parentheses. p<0.1: statistically significant at 10 percent level; p<0.05: statistically significant at 5 percent level p<0.01: statistically significant at 1 percent level.

Table A3: Correlation matrix East Germany

		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
1	Start-up rate 1996-2020	1											
2	Self-employment rate	0.361	1										
		[0.000]											
3	Population share of self-employed 1925 (regular self-employment rate)	0.029	-0.161	1									
		[0.341]	[0.000]										
4	Population share of self-employed and household members 1925 (extended self-employment rate 1925)	0.009	-0.047	0.91	1								
		[0.765]	[0.116]	[0.000]									
5	Relative household size of self-employed 1925	0.004	0.205	0.154	0.437	1							
		[0.893]	[0.000]	[0.000]	[0.000]								
6	Average income of self-employed 1925	-0.033	-0.301	0.518	0.4	0.218	1						
		[0.266]	[0.000]	[0.000]	[0.000]	[0.000]							
7	Employment share manufacturing 1925	-0.098	-0.091	0.494	0.553	0.385	0.588	1					
		[0.001]	[0.002]	[0.000]	[0.000]	[0.000]	[0.000]						
8	Employment share mining 1925	-0.095	-0.053	-0.145	-0.202	-0.287	-0.102	0.183	1				
		[0.001]	[0.076]	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]					
9	Employment share construction 1925	-0.014	-0.014	0.135	0.121	0.007	0.057	0.301	0.284	1			
		[0.640]	[0.645]	[0.000]	[0.000]	[0.805]	[0.057]	[0.000]	[0.000]				
10	Population density 1925	-0.13	-0.362	0.558	0.494	0.147	0.702	0.777	0.26	0.253	1		
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]			
11	Distance to classical university founded before 1900	-0.031	0.279	-0.287	-0.17	0.169	-0.096	0.088	-0.009	-0.241	-0.058	1	
		[0.297]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.003]	[0.773]	[0.000]	[0.052]		
12	Distance to technical university founded before 1900	-0.017	0.077	-0.099	0.039	0.055	-0.315	-0.139	0.018	-0.034	-0.252	-0.281	1
		[0.580]	[0.010]	[0.001]	[0.198]	[0.069]	[0.000]	[0.000]	[0.559]	[0.250]	[0.000]	[0.000]	
13	Number of employees (t-1)	-0.013	-0.437	0.376	0.141	-0.004	0.564	0.144	-0.02	0.007	0.344	-0.286	-0.374
		[0.666]	[0.000]	[0.000]	[0.000]	[0.892]	[0.000]	[0.000]	[0.503]	[0.804]	[0.000]	[0.000]	[0.000]

Notes: p-value in parentheses. p<0.1: statistically significant at 10 percent level; p<0.05: statistically significant at 5 percent level p<0.01: statistically significant at 1 percent level.

Table A4: Summary statistics East Germany

	Mean	Standard Deviation	Minimum	Maximum
Start-up rate	29.17	12.3	10.79	81.03
Self-employment rate	6.7	0.79	4.64	8.56
Population share of self-employed 1925 (regular self-employment rate)	8.42	1.02	6.41	10.44
Population share of self-employed and household members 1925 (extended self-employment rate)	9.93	1.13	7.98	12.98
Relative household size of self-employed 1925	1.36	0.09	1.19	1.64
Average income of self-employed 1925	3.09	0.61	1.91	5.36
Employment share manufacturing 1925	32.42	12.4	11	60.71
Employment share mining 1925	1.8	2.55	0.1	10.61
Employment share construction 1925	4.97	0.61	4.03	6.77
Population density 1925	4.87	0.69	3.75	7.54
Distance to classical university founded before 1900	61.2	34.93	0	166.44
Distance to technical university founded before 1900	106.16	46.22	0	203.77
Number of employees (t-1)	900,27.66	73,998.26	21,162	456,600

Table A5: Main findings for West Germany: Full results table

	(I)	(II)	(III)	(IV)
	Start-up rate (ln)			
	Test H1a/2a/3a		Test H1b/2b/3b	
Population share of self-employed 1925 (regular self-employment rate)	0.312*** (0.018)		0.199*** (0.061)	
Relative household size of self-employed 1925	0.750*** (0.033)		-0.327** (0.159)	
Average income of self-employed 1925	0.112*** (0.018)	0.202*** (0.018)	-0.545*** (0.136)	0.132 (0.173)
Regular self-employment rate X average income of self-employed 1925			0.115** (0.051)	
Relative household size of self-employed 1925 X average income of self-employed 1925			1.085*** (0.153)	
Population share of self-employed and household members 1925 (extended self-employment rate)		0.402*** (0.022)		0.371*** (0.089)
Extended self-employment rate X average income of self-employed 1925				0.031 (0.077)
Employment share manufacturing 1925	-0.194*** (0.009)	-0.191*** (0.010)	-0.203*** (0.009)	-0.191*** (0.010)
Employment share mining 1925	0.031*** (0.003)	0.026*** (0.003)	0.033*** (0.003)	0.026*** (0.003)
Employment share construction 1925	0.083*** (0.013)	0.053*** (0.014)	0.093*** (0.014)	0.055*** (0.017)
Population density 1925	0.015* (0.008)	-0.013 (0.008)	0.026*** (0.007)	-0.013 (0.008)
Distance to classical university founded before 1900	0.010*** (0.002)	0.014*** (0.002)	0.011*** (0.002)	0.014*** (0.002)
Distance to technical university founded before 1900	-0.029*** (0.003)	-0.025*** (0.004)	-0.027*** (0.003)	-0.025*** (0.004)
Federal State dummies	Yes***	Yes***	Yes***	Yes***
Year dummies	Yes***	Yes***	Yes***	Yes***
Number of employees (t-1)	-0.033*** (0.004)	-0.030*** (0.004)	-0.030*** (0.004)	-0.030*** (0.004)
Constant	3.775*** (0.068)	3.740*** (0.077)	4.342*** (0.175)	3.811*** (0.229)
R^2	0.769	0.762	0.771	0.762

Notes: N=8,557: Robust standard errors in parentheses (clustered at the state-x-year-level). *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All continuous variables are log-transformed.

Table A6: Analysis with self-employment rate as outcome variable

	(I)	(II)	(III)	(IV)
	Self-employment rate (ln)			
	Test H1a/2a/3a		Test H1b/2b/3b	
Population share of self-employed 1925 (regular self-employment rate)	0.254*** (0.011)		-0.029 (0.038)	
Relative household size of self-employed 1925	0.698*** (0.023)		-0.243** (0.109)	
Average income of self-employed 1925	0.053*** (0.009)	0.139*** (0.010)	-0.885*** (0.100)	-0.312** (0.126)
Regular self-employment rate X average income of self-employed 1925			0.280*** (0.035)	
Relative household size of self-employed 1925 X average income of self-employed 1925			0.960*** (0.108)	
Population share of self-employed and household members 1925 (extended self-employment rate)		0.339*** (0.013)		0.138** (0.059)
Extended self-employment rate X average income of self-employed 1925				0.198*** (0.056)
Controls	Yes***	Yes***	Yes***	Yes***
Constant	2.571*** (0.044)	2.557*** (0.050)	3.436*** (0.123)	3.014*** (0.156)
R^2	0.470	0.443	0.479	0.444

Notes: N=8,557: Robust standard errors in parentheses (clustered at the state-x-year-level). *** $p<0.01$, ** $p<0.05$, * $p<0.1$. We control historical industry structure (employment share of manufacturing, construction, and mining), population density, and distance to historical centers of knowledge production (classical and technical universities in 1900). We also include the number of employees. All of these variables as well as the main independent variables are continuous and log-transformed. Furthermore, we include year and state fixed effects.

Table A7: Analysis for West Germany with contemporaneous control variables

	(I)	(II)	(III)	(IV)
	Start-up rate (ln)			
	Test H1a/2a/3a		Test H1b/2b/3b	
Population share of self-employed 1925 (regular self-employment rate)	0.302*** (0.018)		0.116* (0.061)	
Relative household size of self-employed 1925	0.676*** (0.036)		-0.398*** (0.145)	
Average income of self-employed 1925	0.104*** (0.018)	0.182*** (0.019)	-0.695*** (0.134)	-0.038 (0.167)
Regular self-employment rate X average income of self-employed 1925			0.186*** (0.051)	
Relative household size of self-employed 1925 X average income of self-employed 1925			1.086*** (0.141)	
Population share of self-employed and household members 1925 (extended self-employment rate)		0.380*** (0.021)		0.281*** (0.086)
Extended self-employment rate X average income of self-employed 1925				0.097 (0.075)
Controls (historical and contemporaneous)	Yes***	Yes***	Yes***	Yes***
Constant	3.801*** (0.068)	3.762*** (0.076)	4.513*** (0.175)	3.986*** (0.223)
R^2	0.781	0.775	0.783	0.775

Notes: N=8,557: robust standard errors in parentheses (clustered at the state-x-year-level). *** $p<0.01$, ** $p<0.05$, * $p<0.1$. We control for historical industry structure (employment share of manufacturing, construction, and mining), population density, and distance to historical centers of knowledge production (classical and technical universities in 1900). Current controls are annual employment change, population change, and changes in the share of highly-skilled employees. All of these control continuous variables are log-transformed. Furthermore, we include state and year fixed effects.

Table A8: Analysis for West Germany with separate introduction of main
variables of interest

	(I)	(II)	(III)	(IV)
	Start-up rate (ln)			
Population share of self-employed 1925 (regular self-employment rate)	0.282*** (0.022)			
Relative household size of self-employed 1925		0.387*** (0.021)		
Average income of self-employed 1925			0.818*** (0.035)	
Population share of self-employed and household members 1925 (extended self-employment rate)				0.185*** (0.020)
Controls	Yes***	Yes***	Yes***	Yes***
Constant	3.919*** (0.065)	3.553*** (0.074)	4.099*** (0.063)	4.537*** (0.064)
R^2	0.752	0.757	0.760	0.749

Notes: N=8,557: Robust standard errors in parentheses (clustered at the state-x-year-level). *** p<0.01, ** p<0.05, * p<0.1. We control for historical industry structure (employment share of manufacturing, construction, and mining), population density, and distance to historical centers of knowledge production (classical and technical universities in 1900). We also include the number of employees. All of these variables as well as the main independent variables are continuous and log-transformed. Furthermore, we include year and state fixed effects.

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