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## **How do local labor market conditions and individual characteristics affect quitting self- employment?**

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## Abstract

**Abstract:**<sup>1</sup> This paper investigates the joint effect of local labor market conditions and individual differences on the duration of self-employment periods. Using register based, data the study focuses on previously unemployed business founders who have received public support to realize their entrepreneurial activities. Local labor market conditions account for a high level of complexity while personal characteristics are related to the founder's employment background. Using accelerated failure time models, controlling for unobserved heterogeneity and allowing for competing exit risk we find that higher and increasing local labor market pressure decreases the duration in self-employment whereas higher perceived (re-unemployment) risk and lower economic prosperity for incumbent firms reduce exit risks. The results reveal that the effect of external conditions is multidimensional and non-linear. On the individual level, we find strong support for the 'hot-house' hypothesis for gaining comparative advantages.

**Keywords:** self-employment, duration, competing risk, local labor market situation

**JEL-Classification:** C41, J62, J64, L26, M13, R23

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<sup>1</sup> Stata 10.1 was used in all calculations. Do-files and results that are discussed but not reported in detail are available from the author. Helpful comments on a previous version of this paper at the 2009 "Annual Meeting of the 'Verein für Socialpolitik'" are grateful acknowledged. All remaining errors are my own.

## 1. Introduction

In the last decade, self-employment has become a well-established subject in labor market research and has substantially contributed to the field of entrepreneurship. In part, this reflects the growing share of individuals who consider self-employment as an alternative income option as it is discussed to offer flexible (re)employment options for migrants and the chance to avoid or to quit unemployment (Blanchflower 2000). Public promotion in this field has increased in the last decade. For example we observed 90.000 financially supported transitions from unemployed into self-employment in Germany per year in the late 1990s, which increased to more than 250,000 per year in 2003. It is therefore of crucial political interest whether such employment positions remain stable and what characteristics extends or shorten the periods in self-employment.

However, research on the context of self-employment longevity has been concentrated on individual attributes showing that socio-demographic characteristics, formal qualification and experience are driving forces for sustainable self-employment periods (e.g., Bates 1990; Cooper et al. 1994; Robinson and Sexton 1994; Gimeno et al. 1997; Cressy 1996). Little is known about the external economic conditions that determine the duration of self-employment and how individual differences interact with labor market conditions. This is surprising since related fields of research show substantial importance of economic conditions related to job choice, firm survival and unemployment duration (e.g., Acs and Armington 2004a and 2004b; Fritsch et al. 2006; Blau 1990 and 1992; Arntz and Wilke 2009). Furthermore, several contributions have been made that explicitly emphasize the importance of regional differences for the initiation of self-employment (Georgillis and Wall 2005; Parker 1996; Bergmann and Sternberg 2006; Wagner and Sternberg 2004 and 2005; Falck 2007).

Up to now, only few studies focusing on the determination of self-employment durations also include information relating to (regional) economic conditions (Taylor 1999; Carrasco 1999; Johansson 2000; Andersson 2006; Cueto and Mato 2006). In particular, little attention has been spent on the potential effects of individual differences across economic settings and on a systematic examination of the role of local labor market conditions. Hence, we use multiple local labor market characteristics and include information about absolute and relative economic pressure, control for the instability of labor market conditions and account for potential non-linear effects. Furthermore, on the individual level, we also study the relevance of characteristics related to the individual's (biographical) employment background and we include interaction effects between individual and regional characteristics.

We use register based data from the German Federal Employment Service (Integrated Employment Biographies, IEB) and focus on individuals who were unemployed before entering self-employment and who received public support ('bridging allowance') for making this

transition.<sup>2</sup> This data has been recently compiled to study individual employment biographies and allows the observing of detailed information of the founder's employment history as well as for a valid identification of local labor markets. The data, moreover, does not suffer from any types of survey bias and covers a period of almost seven years. To account for the time depending nature and right censoring of quits in self-employment we use accelerated failure time models. The empirical investigation also controls for the presence of unobserved individual heterogeneity and studies the determination of duration for competing exit risks to gain deeper insights about the economic motivation to quit self-employment.

For the structure of this study, the investigation is performed in seven sections. Section 2 introduces the framework of the analysis and discusses some related findings. Section 3 describes the data and the variables used, followed by a brief overview of the econometric setting of the empirical investigation (4). Section 5 contains descriptive findings. Finally, the last two sections (6 and 7) present and discuss the results.

## 2 Framework

### 2.1 Theoretical underpinning

To assess the role of local labor market conditions and individual characteristics in exits from self-employment, we shall consider a situation in which a self-employed person  $i$  has two options: i.e. remaining self-employed and earning  $y$  or switching to another position of employment and receiving a wage of  $w$ . The values for  $y$  and  $w$  are assumed to be random draws from distributions of potential incomes (including pecuniary and non-pecuniary income) based on the external labor market conditions  $\pi$  and the individual's characteristics  $x$ . The distributions  $f(y|\pi, x)$  and  $f(w|\pi, x)$  shall define the potential income.  $i$  is a rational agent and will switch if the income changes to  $y < w$ .<sup>3</sup> Assessments in this context will be associated with benefits in terms of option values related to optimal points of exits and are not costless.

Therefore, factors that determine the relative income position will influence self-employment longevity. However, the basic idea is that in all cases new information about  $f(y|\pi, x)$  and  $f(w|\pi, x)$  comes into light, new assessments are made, and this and only this prompts exits.

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<sup>2</sup> This promotion scheme ran until Fall 2006 and was mainly a financial subsidy of the Federal Employment Office to encourage self-employment activities among the unemployed (for other studies that also focus on this population in Germany, see Hinz and Jungbauer-Gans 1999, Pfeiffer and Reize 2000, Wießner 2001, Reize 2004, Caliendo and Kritikos 2007, Oberschachtsiek 2008). Note that the amount of start-ups funded with bridging allowance in 2003 equals at least 50% of the total number of self-employed people out of unemployment (Lehnert 2004). For the international relevance of this population, see, for example: Evans and Leighton (1990), Meager (1996), Carrasco (1999), Böheim and Taylor (2002), Cueto and Mato (2006) or Andersson and Wadensjö (2007).

<sup>3</sup> A critical objection could be made to the effect that rational behavior may be less valid in the context of unemployed founders. However, for the sake of simplicity, we will not account for this in the theoretical discussion.

Accordingly, we assume that two sources exist that determine this evaluation process: time and external changes.

From the perspective of  $i$ ,  $y$  and  $w$  are time-dependent parameters. The start-up of a new venture initially bases on imperfect information due to the limited knowledge of the relevant market structure and of the founder's own (initial) ability to run the business. Bayesian learning produces adjusted information regarding the distribution of  $y$ . Over time, the variance of  $y$  decreases (better estimates of  $y$ ), which reduces the cost/benefit ratio of adjusting  $f(y|\pi, x)$ . Consequently, the exit probability will be higher at the beginning of a new venture and will decrease over time. In addition, differences in learning may also relate to the individual's qualification.

Time also produces new information in relation to the distribution of  $f(w|\pi, x)$ . In particular, the value of human capital that is applicable for wage employment will decrease (relatively). For example, we may observe a declining arrival rate of better job offers across time (Pissarides 1994; Bruce and Schütze 2004; Hyytiäinen and Rouvinen 2008). This corresponds to a reduction of the option value of quitting self-employment. However, the way this affects the evaluation and, therefore, the exit probability depends on the time-dependent pattern of the job offer function, which is simultaneously influenced by labor market conditions and individual characteristics (e.g., Mortensen and Pissarides 1994; Blanchard and Diamond 1994).

Finally, new information also arises if external conditions change. In this case, external changes have a direct influence on the distributions of  $y$  and  $w$ . On the one hand, changes in  $\pi$  affect the level of demand and the costs of external resources. Simultaneously, external changes also determine the distribution of  $f(w|\pi, x)$  as it influences the level of wages, the job arrival rate, and/or job security. Accordingly, if changes in  $\pi$  occur, the densities of assessing  $y_t > w_t$  start to increase because of greater variances in the estimates of  $y$  and  $w$ . Again, the likelihood of switching (potentially) increases. However, the net effect of external changes on exiting self-employment is complex. Deriving clear-cut expectations regarding the effect of external changes on the exit choice depends on which income option is affected to a greater extent.

## **2.2 Selected findings for regional and individual characteristics**

The empirical evidence of how variance in external conditions affects relative income position in wage work and self-employment is ambiguous (for an overview, see Table A1 in the Appendix). Taylor (1999), Carrasco (1999), and Andersson (2006), for example, find that the hazard rate rises with an increase in the unemployment rate. This implies that self-employment incomes are relatively more affected by an economic downturn than incomes in the wage work sector. In contrast, Johansson (2000) and Cueto and Mato (2006) find a negative correlation,

indicating a greater reduction in external income options than in self-employment incomes. This finding reflects that high levels of unemployment associated with low-quality wage offers (Pissarides 1994). Returning to wage work will thus be more costly under the condition of high unemployment and this, in turn, reduces hazards arising from self-employment.

Tervo and Haapanen (2009) consider indicators for the development of local labor market conditions. They find that the ratio of the unemployment rate of the current and lagged periods dominates the effect of the level of unemployment. This finding suggests that it is not the level of local labor market pressure per se but the change in external economic conditions that causes exits. Moreover, this result is also in line with the argument of a higher density in evaluating  $y$  and  $w$  due to external changes.

Kangasharju and Pekkala (2002) suggest that the effect of economic changes for different income options may differ along qualifications. They show that across qualification, individuals differ in their reactions to economic conditions and in the way in which they quit self-employment. In a period of an economic upturn, they find an increased likelihood of quitting for the highly qualified self-employed individuals while an economic downturn is correlated with a lower exit probability. This result implies that income elasticity is higher for highly qualified wage workers than for highly-qualified self-employed persons. In addition, this finding may also reflect the presence of differences in the job offer rate between different types of wage work, conditional on qualification and external conditions (Pissarides 1994). As a result, the highly qualified will face higher opportunity costs if market conditions improve.

Previous empirical studies have also emphasized that external conditions have varying effects on self-employment hazards that occur for different reasons (e.g., Taylor 1999; Carrasco 1999; Johansson 2000). In particular, the newly self-employed evaluate the internal income  $y$  not only to  $w$  but also to  $u$  (denoting alternative post-exit positions). For example, exits may be followed by a period of unemployment, retirement, parental leave or concentration on household tasks. Previous studies do not reveal consistent findings as to how involuntary (e.g., bankruptcy or unemployment) and voluntary exits (e.g., wage work) relate to external changes (see Table 1). However, previous research suggests that the importance of external conditions appear to be more important for exits into wage work than for involuntary exits. This implies greater elasticity in the sales functions than in the job offer rate conditional on the variation of external conditions.

On the individual level gender, age, educational attainment, and professional background are usually discussed as having a substantial impact on the stability of self-employment periods (for an overview, see Santarelli and Vivarelli 2007; Giannetti and Simonov 2004). In particular, the net effect of human capital attributes and other individual characteristics on success in self-employment are theoretically part of different mechanisms.

First, human capital is usually discussed to play an important role with respect to the individual's productivity. In this context qualification is often expected to have direct effects on the entrepreneurial and managerial capabilities (e.g., Brüderl et al. 1992; Bates 1990). Furthermore, qualification also has indirect correlations with success since it reflects past income options. Research shows that males, middle-aged people and higher qualified business founders are also less capital constrained when starting a business (Brüderl et al. 1992; Cressy 1996; Chandler and Hanks 1998; Parker and van Praag 2006). In addition, research also shows that the composition of the individual's qualification correlates with motivation or/and individual personally traits (e.g., Rauch and Frese 2000; Silva 2007).

However, the net effects of individual characteristics for self-employment duration are ambiguous. Evans and Leighton (1989) for example show that returns to human capital are lower in self-employment than in wage work. Van der Sluis et al. (2005) support this and show that the returns to wage work are higher for the wage workers than for the self-employed. This would imply, in part, a negative correlation between the duration of self-employment and qualification as reported, for example, in Johansson (2000) and Andersson (2006). However, other studies report insignificant or positive correlations between qualification and survival (Brüderl et al. 1992; Taylor 1999; Bates 1990). In addition, results also depend on the observed exit state. Johansson (2000) for example finds that education decreases the risk to quit into unemployment while it is insignificant for exits in general. Likewise, Cueto and Mato (2006) find that individuals with a management background are more likely to have failure exits while it is irrelevant for exits into wage work.

### **3 Data and variables**

#### **3.1 The data sources**

The data used for this analysis come from the Integrated Employment Biographies (IEB), which is a merged dataset compiled by the Institute for Employment Research (see Jacobebbinghaus and Seth 2007).<sup>4</sup> The IEB consists of four distinct sources of register data originating from the registers of the Federal Employment Agency. These registers cover employment and benefit histories dating back to 1990 and official registrations for job searches, unemployment periods, and participation in active labor market programs dating back to 1999. The information on employment episodes covers at least the period up to the end of 2005 and is updated on a daily basis.

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<sup>4</sup> Note that access to this data (IEB) is usually limited to a 2.2% random sample (named IEBS) offered by the research data centre of the Federal Employment Agency (see <http://fdz-iab.de>).



Each record in the dataset is linked with socio-economic characteristics and source-specific information<sup>5</sup> taken from the most current information available when the record was generated. This provides convenient time-dependent information combined with detailed information on an individual's employment history. In addition, the data uses secondary information taken from the Establishment History Panel<sup>6</sup> (EHP; for details see Spengler 2008) and regional labor market information from the official statistics of the Federal Employment Agency. This regional information is merged with the individual data at three-monthly intervals.<sup>7</sup>

Individual characteristics cover socio-demographic information, qualifications, prior duration of unemployment, job characteristics of past employment history (e.g., income, firm size, occupation; within the last five years), and information on the founding year and main profession practiced during previous employment periods. The study also uses the official statistics of the Federal Employment Agency to supplement the data with detailed characteristics of the local labor market situation. Furthermore, the EHP enables the identification of movements of establishments at local level. This information is incorporated on an annual basis.

### **3.2 Preparation of the data**

A drawback of the IEB is its lack of (direct) information about self-employment projects. The data only include information about periods of participation in self-employment promotion programs funded by the Federal Employment Agency. However, the requirements of the legal system and the regulation of the funding are sufficient to ensure the valid identification of self-employment observations.<sup>8</sup>

Specifically, the legal system requires that the start of a self-employment period be close to the start date of the subsidy. This enables the use of the start date of participation as the starting point of the observation of the self-employment. Any observation in the data after the initiation of the participation is then used to identify the point at which an individual quits self-employment (excluding additional promotional periods in self-employment). An exit event is thus defined according to the change of employment position and differentiates between exits into

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<sup>5</sup> The employment register adds information on wages, type of employment, job characteristics, and qualifications. Benefit histories cover information on the type and amount of benefits received. The participation-in-measure register mainly contains information on measures and only includes approximate personal characteristics. Finally, the job search register adds detailed attributes on individuals' qualifications and job search profiles.

<sup>6</sup> The Establishment History Panel (EHP) contains information on employment notifications valid on 30 June each year, which are aggregated at the establishment level.

<sup>7</sup> Due to computing restrictions, the merging is not performed on a monthly basis.

<sup>8</sup> The bridging allowance is a nationwide program which dates back to 1995 in its most latest form and ran until fall 2006. This program offered the full payment of unemployment benefits during the start-up period of a new business. Applications were approved if an applicant's unemployment period ended with the self-employment and if an independent authority evaluated the business concept as potentially successful (for details, see Caliendo and Kritikos 2009).

unemployment, (full time) wage work positions, and other states. Finally, the duration of the self-employment period is measured as the difference between the start date of participation and the date of the first observation thereafter. However, it should be noted that the exact date of the termination of the self-employment period and the reason for it is not observed in the data.<sup>9</sup>

Local labor markets are identified using the Federal Employment Agency's labor market district classification. This follows Arntz and Wilke (2009) and allows for an appropriate approximation of a labor markets context that is (on average) relevant to the individual's behavior. To account for the spatial effects, the study also uses an alternative identification that defines local labor markets on the basis of their commuter structures (see Section 6.6 for details).

Finally, for methodological reasons, the population is limited to participations between 1999 and 2002<sup>10</sup> and also excludes individuals with implausible<sup>11</sup> periods of participation and individuals with more than three notifications of self-employment promotion within the time span under observation. Due to computing restrictions, the final data set uses a 50% random draw of the constructed data. This results in a data set based on 161,086 founders, of whom 89,529 quit self-employment within the observation period (maximum: 83 months). Further data processing mainly relates to single variables and is reported Table A.2 in the Appendix.

### **3.3 Relevant attributes and hypothesis**

#### *Local characteristics*

In keeping with previous studies (e.g., Taylor 1999), we will use the unemployment rate as an overall measure of regional economic pressure. In particular, the unemployment rate measures the general mismatch between the demand for and supply of labor on the labor market. To overcome concerns of endogeneity, we use the first monthly regional unemployment rate for the entire split time interval. In keeping with previous findings, we may expect different correlations between the unemployment rate and the self-employment duration of individuals. An increasing unemployment rate may promote exits from self-employment due to deteriorating economic conditions and this raises the relative income position in favor of wage work and

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<sup>9</sup> Self-employment activities may have been terminated at an earlier or later point in time than observed in the data. It is also possible that exits will never be observed in the data, e.g., if the individual retires or in cases of full-time household production. For the interpretation it is also important to keep in mind that 'other states' include minor employment and official job search periods. It should also be noted that entitlements to unemployment benefit will end after a certain period and that this reduces the likelihood of observing exits into unemployment following long periods of self-employment and increases the likelihood of observing 'other' exits.

<sup>10</sup> In 2003 and 2004, several changes were made that relate to the promotion of self-employment by the Federal Employment Agency in Germany (see Caliendo and Kritikos 2009). This restriction ensures that the population is most similar to founders who did not start from a position out of unemployment (see Hinz and Jungbauer-Gans 1999).

<sup>11</sup> These are observations with less than 60 days of participation (which is a likely indicator of terminations) and periods of participation in excess of 740 days (too long, incorrect notifications).

unemployment position. However, the structure may also be inversed if we expect that good jobs become rare, a development that reduces the option value of future wage work positions in cases of unemployment.

In addition, we also control for a running unemployment index which standardizes the local unemployment rate to 100 in  $t_0$ . This adopts the concept developed by Tervo and Haapanen (2009) and Cueto and Mato (2006) and enables the direct measurement of changes in external conditions since the individual has entered self-employment. As in the case of the unemployment rate, without further assumptions, previous findings and theoretical considerations do not enable the formulation of precise expectations in relation to the correlation between this attribute and the individual's self-employment longevity.

Furthermore, the proportion of vanishing establishments (exits and movements; firm hazard) per year and region is used as an inverse measure of regional economic prosperity. To address endogeneity concerns we use one-year lagged information. The intuition behind this attribute is that firm mobility and firm deaths reflect a decrease in the degree of expected economic prosperity for a local market. However, firm hazard may also characterize reduced competition, which opens greater market shares for new firms or which simply forces individuals to remain self-employed due to the lack of alternative employment options in wage work. Therefore, the determination of the individual's self-employment duration remains unclear.

In line with Parker (1996), we will also test the (re-)unemployment risk in each region in relation to its relevance for an individual's exit probability. Risk will be defined in terms of local employment instability. Employment instability is defined as the error variance of a time-series estimation (root mean squared error) of the local monthly unemployment rate covering the period between 1999 and 2004.<sup>12</sup> We expect that returning to wage work is more costly in regions with high variance because of greater re-unemployment risks. The option value of wage work will decrease in the context of high unemployment risks. Therefore, increased variance should be related to a prolongation of durations in self-employment.

Finally, we distinguish between east and west Germany to take into account the general economic differences between the regions in east and west Germany. As is case the for the measurement of other local labor market conditions, the expected findings remain ambiguous.

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<sup>12</sup> The root mean squared error (rmse) is the difference between an estimated quantity and the true value of the quantity that is estimated. Using the rmse instead of the variance has two major advantages: first, this measure is less sensitive to seasonal employment fluctuations than variance (the correlation between rmse and variance is 0.82), because it does not measure the difference from an inflexible reference point (the mean). Second, and accordingly, the rmse allows the inclusion of some types of 'unexpected' development and appears, therefore, to be more accurate in addressing the underlying intention of the measure.

### *Individual characteristics and interaction effects*

Blanchflower and Meyer (1994), Wagner (2004), and Parker (2009), for example, provide evidence to the effect that, for reasons of self-selection, individuals starting a new venture mainly come from small firms (the so called ‘hot-house’-hypothesis). The argument behind this finding is that small firms may provide more applicable knowledge and networks and may also foster diversity in an individual’s skill set (see Lazear 2005; Wagner 2003 and 2006). To approximate the individual’s working background we will use the latest employer’s median firm size (within a five-year period). Overall, we expect to find a positive correlation between a small-firm background and self-employment duration.

Lazear (2005) and Parker (2007) also emphasize the importance of applicable knowledge provided by previous job experience; this has also been accentuated for formerly unemployed founders by Wießner (2001). To follow up on this idea, the study includes information about the last position held (manager and master craftsman) and information as to whether an individual has worked in a commercial profession. Moreover, the data enables controlling for the level of unobserved productivity in terms of a wage premium in the last employment position before the start-up (Andersson and Wadensjö 2007).<sup>13</sup> Overall, these attributes are assumed to reflect increased productivity, which should cause a prolongation in self-employment. However, they also reflect high opportunity costs which may increase exit probabilities. Accordingly, we may expect shorter durations in relation to exits into wage work positions.

The study uses biographical employment information to account for a founder’s motivation in starting a business. The unemployment duration and ‘minor employment position’ (*‘geringfügige Beschäftigung’*) before entering self-employment approximately address ‘push motives’ (e.g., Taylor 1999; Johansson 2000; van Praag 2003): we expect shorter self-employment durations in relation to these attributes. In addition, the number of different jobs held (in the past two years) operates as an indicator for an individual’s (voluntary and involuntary) disposition towards changing jobs (Hyytinen and Ilmakunnas 2007; the switching disposition’-hypothesis).<sup>14</sup>

Finally, we test the importance of the founder’s human capital in the context of the local labor market situation using the interaction of individual attributes and local labor market characteristics. However, the local labor market is multi-dimensional. In this study we concentrate on the development of the local labor markets. Therefore, the investigation uses the

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<sup>13</sup> More precisely, we use the difference between the realized and predicted monthly gross income based on a selected set of covariates (e.g., age, schooling, job changes, gender, job position, size of the establishment; conditional on the type of profession and part-time or full-time status). In cases, in which the realized income is 1.66 (3<sup>rd</sup> quartile) times larger than the expected (predicted) income, we define this as a wage premium. We used this threshold to emphasize the notion of a ‘high’ wage premium and to overcome potential measurement errors.

<sup>14</sup> In accordance with Lazear (2005), job changes may also operate as an indicator for the balance of an individual’s skill set. However, we will not pursue this perspective based on the number of job changes.

unemployment index as the regional component for the identification of interaction effects. According to the findings of Kangasharju and Pekkala (2002) and in keeping with those of Pissarides (1994), we will expect more qualified founders to show greater elasticity in their reactions to external changes.

#### 4 Econometric setting

To conduct the empirical investigation we will use accelerated failure time models which define an episode  $\tau$  as a result of the time  $t$  that is scaled by a set of attributes ( $x$ ) given a certain time-scaling function. Technically, this is

$$\tau_i = \exp(-x_i\beta_x)t_i, \quad (1)$$

where  $\tau$  denotes a random variable in  $t$  and  $\beta_x$  is a vector that describes the average (scaling) impact of a covariate on the expected length of an episode. In the current setting, this is the time elapsed until the quitting of self-employment is observed and its correlation with the explanatory attributes. In the basic form the model is based on a linear model of the natural logarithm of survival time (Cleves et al. 2004):

$$\begin{aligned} \ln(t_i) &= x_i\beta_x + \ln(\tau_i) \\ &= \beta_0 + x_i\beta_x + v_i \end{aligned} \quad (2)$$

where the logarithm of the process time  $\ln(t_i)$  is a linear function of an individual's characteristics  $x$ . The error term  $v$  is assumed to follow a certain distribution and captures the properties of  $\tau$ . For example, if  $v$  follows the standard normal distribution, the corresponding survival time  $\tau$  is subject to the log-normal distribution.

In the modeling approach, we will allow for unobserved heterogeneity. Absent information will be treated as a (systematic) misspecification of the model, which we control for by assuming that it can be captured due to a certain specification of a random effect (Gutierrez 2002).<sup>15</sup> More precisely, we separate the error  $v_i$  term into a random component ( $\varepsilon$ ) and an individual systemic component ( $\alpha$ ):

$$\ln(t_i) = \beta_0 + x_i\beta_x + \varepsilon_i + \alpha_i, \quad (3)$$

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<sup>15</sup> Missing information may lead to a misspecification of the duration model, causing an inadequate representation of the timing of exits. Limited information may be related to the characteristics of the start-up project or to limited individual (e.g., individual risk aversion or the household context) and regional information (e.g., competition).

where  $\alpha$  captures an additional time dependency in the error term. Taking frailty into account, we specify the unobserved heterogeneity to follow a gamma distribution with a mean of one and a variance of  $\Theta$  (see Cleves et al. 2004).<sup>16</sup> Given the set of observed information as well as frailty, we obtain

$$\ln(t_i) = \beta_0 + x_i \beta_x + x_r \beta_x + x_{rt} \beta_x + x_{rt,i} \beta_x + \varepsilon_i + \alpha_i. \quad (4)$$

All information referring to the individual level is time-invariant ( $x_i$ , capturing  $t_0$ ). Regional attributes address both fixed and time-varying effects ( $x_r$  and  $x_{r,t}$ ).  $x_{r,t,i}$  represents interaction effects between the local labor market situation and individual characteristics.

To account for different economic reasons for leaving self-employment, we will specify formula (4) for different exit events:

$$\ln(t_i^j) = f(x_i^j, x_{rt}^j, x_r^j, x_{rt,i}^j, \beta_x^j, \sigma, g(\alpha_i^j)), \text{ with } j = 1, \dots, j \text{ and } \tau_j = \min\{\tau_1, \dots, \tau_j\}. \quad (5)$$

For the investigation we will focus on a distinction between exits into employment and exits into unemployment. Observations that exit into a different destination than those of interest are treated as censored. Competing exit risks must be mutually exclusive. That means that the considered exits must describe distinct transition states ( $j=1$  is not a subset of  $j \neq 1$ ). Furthermore, for a consistent interpretation, we must assume conditional independency of the competing risks (see Thomas 1996 and Cleves et al. 2004).

## 5 Descriptive findings: profile, exits, and post-exit status

### 5.1 The profile of self-employment out of unemployment and the macroeconomic situation

As Table 1 shows, the population consists mainly of males, middle-aged individuals around the age of 38, and highly qualified people (see Table A.3 in the appendix for correlations). Almost 50% came from a small-firm background. Compared to Wagner's (2004) findings, this is slightly higher than the proportion found among German nascent entrepreneurs (44%).

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<sup>16</sup> Gauss or gamma distributions are usually used to control for unobserved heterogeneity in duration models (Gutierrez 2002). We chose the gamma distribution because it is more flexible. Heckman and Singer (1984) have expressed the criticism that the choice of the parameterization may be sensitive to estimates of  $\beta$ . However, following Manton et al. (1986), we assume that the better the parameterization of the baseline function, the lower the sensitivity.

In addition, with reference to Lazear's 'Jack-of-all-Trades' hypothesis (Lazear 2005), the average total number of job changes within the two-year period prior to starting the business is around 1.3.<sup>17</sup> 73% of the founders had experienced a longer spell of unemployment (> 4 months) before entering self-employment. In accordance with Bögenhold and Staber (1991) and van Praag (2003), this is indicative of a sample population that appears to be more likely to be pushed into self-employment.

Note that the period under observation (1999 to 2005) is characterized by an economic downturn.<sup>18</sup> The non-weighted average unemployment rate across all regions increased from 10.4% in 2000 to 13.03% in 2005. This picture shows strong variation at regional level. The spread (min-max-distance) of the local unemployment rates rose from a span of 24 percentage points to 26 percentage points. In addition, between 1999 and 2005, the unemployment index varied between 40 and 142 points. Likewise, the share of vanishing firms (firm hazard) ranges from 6% to 13.8% in 2000 and increases to between 8.7% and 15.5% in 2005.

## 5.2 Exits and exit status

Table 1 also displays the distributions of the covariates conditioned for different types of exits from self-employment (exits in general, exits into wage work, exits into unemployment, and exits into other states). Males, founders with higher qualifications (high school diploma, college or university degree, master craftsman qualification with premium income and short unemployment duration), and founders who have an employment background associated with small business tend to be less likely to exit. Focusing on the post-exit states the results show that individuals with higher qualifications tend to be more likely to switch to wage work positions. In addition, exits into unemployment appear to be relatively more likely in east Germany.

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<sup>17</sup> Silva (2007) reports an average of almost 1.8 jobs held by Spanish adults before setting up a business. Wagner (2006) finds a higher figure for the number of fields of experience (3.6) among German nascent entrepreneurs. Both studies use definitions that differ from the one used here and will systematically lead to higher figures.

<sup>18</sup> Note that the economic situation in Germany changed in 2006 with an improvement of the macro-economic conditions.

**Table 1: Descriptive statistics for entries and exits**

variable	entries				exits						
	n	all		into employment		into unemployment		into unknown status			
		mean	stdv	mean	stdv	mean	stdv	mean	stdv	mean	stdv
	161,086		89,529		24,901		53,598		11,030		
<b>individual characteristics</b>											
gender (male) <sup>d</sup>	0.71	0.452	0.69	0.461	0.68	0.465	0.74	0.441	0.52	0.500	
age <sup>n</sup>	37.79	8.637	37.90	8.922	36.73	8.088	38.55	9.350	37.37	8.262	
<b>motivation</b>											
short unemployment (< 4 months) <sup>d</sup>	0.27	0.444	0.23	0.424	0.26	0.437	0.23	0.421	0.21	0.406	
minor employment <sup>d</sup>	0.05	0.212	0.05	0.222	0.04	0.201	0.05	0.207	0.11	0.309	
number of job changes <sup>n</sup>	1.34	0.691	1.38	0.736	1.42	0.730	1.38	0.746	1.31	0.691	
<b>qualification</b>											
schooling (>= high school) <sup>d</sup>	0.28	0.449	0.27	0.444	0.32	0.466	0.23	0.419	0.38	0.484	
academic degree <sup>d</sup>	0.16	0.371	0.16	0.362	0.18	0.383	0.13	0.339	0.21	0.410	
master craftsman / foreman <sup>d</sup>	0.03	0.168	0.02	0.126	0.02	0.136	0.02	0.123	0.01	0.111	
management <sup>d</sup>	0.06	0.228	0.05	0.225	0.07	0.250	0.05	0.217	0.04	0.199	
commercial background <sup>d</sup>	0.17	0.371	0.18	0.386	0.20	0.399	0.17	0.378	0.19	0.389	
wage premium <sup>d</sup>	0.26	0.441	0.25	0.431	0.30	0.457	0.22	0.417	0.24	0.427	
small business (< 20) <sup>d</sup>	0.51	0.500	0.47	0.499	0.48	0.500	0.46	0.498	0.49	0.500	
<b>local labor market</b>											
unemployment rate <sup>n,t,r</sup>	12.30	5.365	12.57	5.439	11.39	5.122	13.30	5.541	11.72	5.031	
unemployment index <sup>n,r,t</sup>	100.00	0.000	103.38	13.375	102.40	14.551	103.22	12.370	106.42	14.802	
variation index <sup>n,r</sup>	0.41	0.193	0.41	0.189	0.39	0.181	0.42	0.192	0.38	0.185	
% vanishing establishments <sup>n,r,t-1</sup>	9.81	2.056	10.53	2.070	10.13	2.069	10.70	2.063	10.61	1.983	
east Germany <sup>d</sup>	0.29	0.456	0.28	0.448	0.20	0.397	0.34	0.472	0.19	0.391	
<b>cohort</b>											
1999 <sup>d</sup>	0.21	0.411	0.22	0.415	0.27	0.445	0.20	0.400	0.20	0.403	
2000 <sup>d</sup>	0.24	0.429	0.25	0.431	0.28	0.447	0.23	0.423	0.24	0.429	
2001 <sup>d</sup>	0.25	0.432	0.25	0.431	0.23	0.418	0.26	0.437	0.24	0.427	
2002 <sup>d</sup>	0.29	0.456	0.29	0.452	0.23	0.418	0.31	0.462	0.31	0.463	
<b>profession</b>											
1 (primary sector) <sup>d</sup>	0.02	0.133	0.02	0.128	0.01	0.115	0.02	0.134	0.02	0.124	
2 (trade/manufacturing) <sup>d</sup>	0.39	0.488	0.36	0.479	0.32	0.468	0.39	0.489	0.24	0.429	
3 (commercial/administration) <sup>d</sup>	0.34	0.474	0.37	0.482	0.39	0.488	0.35	0.478	0.38	0.485	
4 (transport/security/post) <sup>d</sup>	0.08	0.269	0.09	0.287	0.09	0.283	0.10	0.295	0.07	0.252	
5 (medical/care) <sup>d</sup>	0.04	0.186	0.02	0.153	0.03	0.181	0.02	0.128	0.04	0.191	
6 (education/social welfare) <sup>d</sup>	0.05	0.215	0.05	0.218	0.06	0.240	0.04	0.195	0.07	0.263	
7 (else profession) <sup>d</sup>	0.09	0.280	0.10	0.293	0.09	0.280	0.08	0.274	0.18	0.384	

The table reports mean values and standard deviation (stdv); note that the mean reflects shares in cases of a dummy variable d stands for a discrete change of dummy variable from 0 to 1; n stands for a numeric variable (metric); r = regional information, t = indicates time varying attributes (monthly information changing on a quarterly basis; in the case of vanishing establishments annual information is used); source: IEB; own calculations

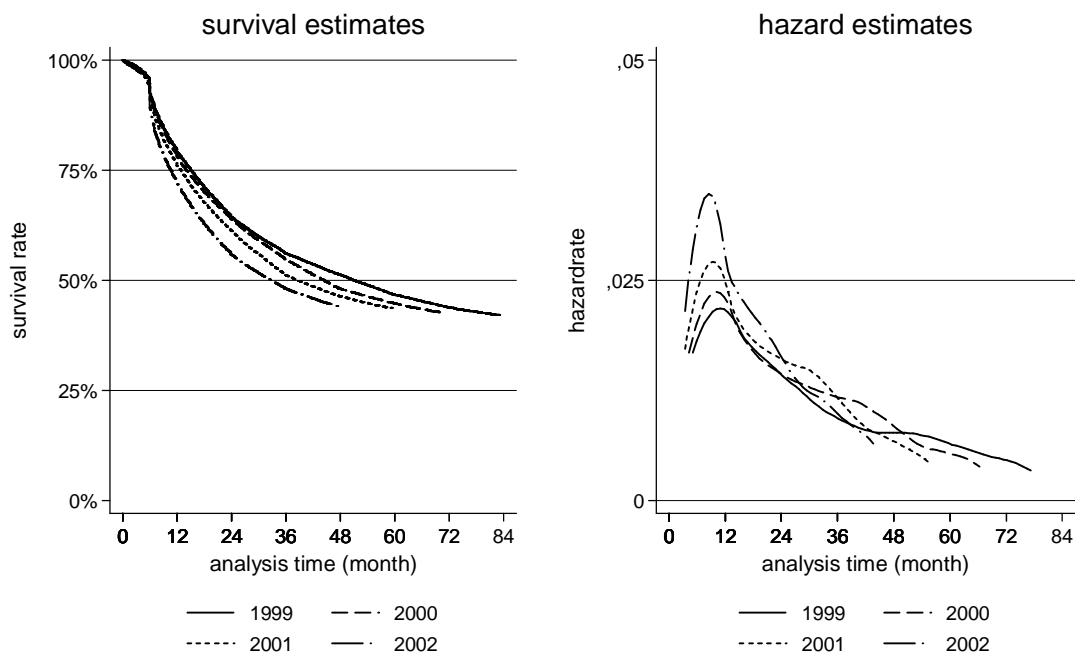
Information related to the time-dependent nature of exit is displayed in Figure 1. Specifically, it shows the survival function (left graph) and the related hazard function (right



graph) based on the Kaplan-Meier (1958) procedure.<sup>19</sup> For information purposes, both functions are displayed separately for each entry cohort.

As can be seen on the graph, time survival is high at the beginning of the process (above 95%) and rapidly decreases after a period of six months (end of the promotions period). After a period of 36 (24) months, almost 55% (60%) of all entries are still self-employed. This decreases to a share of 46% until the end of the observation period (83 months). This indicates much lower survival rates than those found in previous research.<sup>20</sup> In keeping with the survival function, the hazard rates (see right graph) increase during the first months and then decrease before the twelfth month of activity. In conclusion, the hazard rate follows a ‘sickle-shaped’ function which is also reported in earlier research (Brüderl et al. 1992; Taylor 1999; Wießner 2001; Oberschachtsiek 2008).

**Figure 1: Time dependency of self-employment exits**



source: IEB; own calculations

<sup>19</sup> The survival function estimates for each time interval the probability that those who have survived the beginning of the interval will survive to the end. Therefore, it defines as the product of the conditional probabilities of surviving each time interval. Accordingly, the hazard function defines as the risk of a failure event in a given time interval conditional to the population that is at risk of failing in that given time interval.

<sup>20</sup> Wießner (2001), for example, reports survival rates of almost 70% after a period of three years. Hinz and Gungbauer-Gans (1999) find survival rates of 80% after two years, and Caliendo and Kritikos (2007) report survival rates of between 65% and 70% after a period of two years. However, variances may arise from different observations periods and from different data sources. In particular, previous research focuses on survey data which may suffer from a participation bias.

Returning to Table 1, we also find that almost 60% quit self-employment by exiting into unemployment and that only 28% entered into new employment; this is similar to the findings in Oberschachtsiek (2008).<sup>21</sup> However, focusing on the post-exit state does not answer the question as to whether the observed state remains stable. The data show that almost 45% of all exits into employment fall back into unemployment and around 36% of those who have quit self-employment by starting a period of unemployment re-enter a wage work position. In addition, we find that 50% of all post-exit states change within the first six months and that 75% change within one year.

## 6 Determinants of duration

### 6.1 Model selection and the value of local information

Since accelerated failure time models allow different underlying time-scaling functions, we tested different specifications for capturing the most adequate parameterization of the model. We use likelihood-ratio tests (LR) and the Bayesian information criteria (BIC; see Raftery 1986 and Burnham and Anderson 2004). According to the hazard rate function displayed in Figure 1, we tested gamma, log-normal, and log-logistic distributions, of which the log-normal duration model shows the best fit to the data.<sup>22</sup> Tests for unobserved individual heterogeneity indicate that individual frailty can not be rejected while controlling for individual and regional characteristics.<sup>23</sup> Therefore, all model specifications used for the empirical investigation below control for an individual gamma distributed frailty.<sup>24</sup> For a graphical assessment of the model selection, see Figure A.1 in the appendix.

Before starting the investigation of single attributes, we will first examine the relative importance of local information in explaining self-employment longevity. Using likelihood ratio tests different model specifications are studied which include different sets of covariates. We will

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<sup>21</sup> Note that for the population of business founders who were not unemployed before becoming self-employed, Taylor (1999) and Johansson (2000) find an inverse picture in which most self-employed people end their period of self-employment by entering a new job or quitting self-employment voluntarily.

<sup>22</sup> In addition, we also tested the shape parameter of the gamma-distribution in its support for a log-normal distribution of the self-employment durations (see Cleves et al. 2004) which also supports this choice. Conditional on all exits, the shape parameter  $\kappa$  is not significantly different to zero, which supports the choice of a log-normal distributed duration model. However, conditioning on exits into employment and unemployment does not prefer a specific model.

<sup>23</sup> The null hypothesis is tested that the variance parameter  $\theta$  equals zero (see Guiterrez 2002).

<sup>24</sup> In keeping with the objections stated by Heckman and Singer (1984), we do not find strong differences related to the inclusion and the specification of the frailty term.

use the development of the likelihood ratio and the BIC as indicators for the improvement of the entropy (see Table 2).<sup>25</sup>

**Table 2: LR-test and the entropy of nested models**

specification	all	exits	
		employment	into unemployment
reference (model 1)	LR: 3,163*	LR: 2,722*	LR: 2,381*
(introducing b1)	BIC: 436,000	BIC: 184,658	BIC: 312,585
human capital (model 2)	LR: 4,440*	LR: 970*	LR: 3,269*
(adding b2 to model1)	BIC: 431,719	BIC: 183,875	BIC: 309,475
labor market I (model 3a)	LR: 56*	LR: 136*	LR: 370
(adding b3a to model2)	BIC: 431,669	BIC: 183,753	BIC: 300,121
labor market II (model 3b)	LR: 24*	LR: >1	LR: 54*
(adding b3b to model2)	BIC: 431,658	BIC: 183,767	BIC: 309,082
labor market III (model 3)	LR: 1,015*	LR: 494*	LR: 1,315*
(adding b3 to model2)	BIC: 430,820	BIC: 183,496	BIC: 308,276
H*R (model 4)	LR: 90*	LR: 16*	LR: 73*
(adding b4 to model3)	BIC: 430,831	BIC: 183,582	BIC: 308,305

table reports Likelihood Ratios (LR) and the Bayesian Information Criteria (BIC)  
 explanation: \* indicates a significant rejection of the null-hypothesis of the Likelihood Ratio test;  
 the tests sequentially relates to the less complex model  
 content of the blocks: b1 (gender, age (+sq), cohort, profession, east/west); b2 (short unemployment, minor employment, number of job changes, schooling, academic degree, crafts master, management, commercial background, wage premium, small business); b3a (unemployment rate); b3b (unemployment rate squared); b3 (unemployment rate (+sq), unemployment index (+sq), variation index (+sq), vanishing establishments (+sq)); b4 (interaction effects as displayed in Table 5)  
 source, IEB; own calculations

As Table 2 also shows, the equality of the models can be rejected for all steps and for all types of exits. Concerning the regional attributes that are introduced in model 3, this indicates that controlling for regional characteristics statistically improves the modeling of self-employment durations. However, the sequential introduction of new attributes as displayed in Table 2 also shows a decrease in the relative informational contribution of the included covariates. Testing different orders for the inclusion of attributes reveals that the highest net gain relates to the introduction of individual characteristics. Furthermore, Table 2 also reports that the relative importance of different sets of covariates in explaining self-employment duration differs depending on the type of exit. Unlike previous findings, our results suggest that external

<sup>25</sup> The profession, the start-up cohort, gender, age, and the East/West classification are used to conduct the reference model (model 1). The second set of attributes adds further individual characteristics (e.g., motivation, qualification, model 2). Model 3 and model 4 incorporate regional characteristics, in which the latter also includes the interaction between individual characteristics and the (linear) unemployment index.

conditions predominantly correlate with exits into unemployment. In sum, the highest entropy relates to the model specification that adds individual and regional characteristics (model 3).<sup>26</sup>

Second, in accordance with section 2, we also test the net gain of a higher complexity in addressing local labor market conditions. Again, we use likelihood ratio tests for model specifications that include different sets of regional characteristics. As can be seen from Table 2 (see specification ‘labor market II’), introducing a squared term yields a statistical significant improvement of the entropy for all type of exits.<sup>27</sup> Furthermore, the sequential inclusion of further local information (linear and squared term of the unemployment index and firm hazard; not displayed) also rejects the equality of the models for all types of exits with the exception of the variation index.<sup>28</sup> Therefore, there is strong support for the use of multiple measures in addressing local labor market conditions. Also notice that concerning the entropy of the statistical modeling greatest improvements result from controlling for the unemployment index and firm hazards, which – in the case of the unemployment index – support the high relevance of external changes as discussed earlier and also reported in Tervo and Haapanen (2009).<sup>29</sup>

## 6.2 Testing single attributes

Two model specifications are differentiated for the investigation. First, results concerning local and individual characteristics are based on the model specification with the highest entropy (model 3) and are reported in Table 3. Second, the specification as described in model 4 is used for the investigation of the interaction effects. The results are displayed in Table 4. Note that the interpretation of the coefficients in log-normal duration models is very close to a percentage change in  $t$  related to a change in  $x$  ( $\ln(t_i)/\Delta x$ ), in which the natural exponent of the coefficients represents the time ratio. Negative values of  $\beta_x$  ( $e^\beta < 1$ ) are associated with shorter expected durations and therefore accelerated exits. It should also be noted that the results concerning the competing exit risks must be interpreted with care due to data limitations (see section 3) and due to the high dynamics of the post-exit employment states. In particular, the latter point may limit the validity of a distinct identification of the considered exit risks. Furthermore, it may be questionable as to whether exits into wage work and unemployment are independent in a very

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<sup>26</sup> The BIC supports this pattern. However, the BIC also shows a negative improvement of the entropy relating to the introduction of the interaction between local characteristics and individual attributes.

<sup>27</sup> We also tested cubic effects of the unemployment rate. However, returns to this inclusion are not satisfying in terms of statistical significance and model improvement.

<sup>28</sup> The inclusion of the variation index only showed a robust significant model improvement for exits into unemployment. Significant contributions related to the LR tests depend on the order of the included set of covariates.

<sup>29</sup> We also tested the entropy of the model specification based on model 2 plus the linear and squared effect of the unemployment rate in comparison to the same specification based on the unemployment index. The BIC indicates higher entropy for the latter specification which also supports this interpretation.

narrow sense when focusing on local labor markets. Therefore, results are reported for the two types of competing exit risks and exits in general.

#### *Local labor market characteristics*

As it can be seen from Table 3 the results show that a one percentage-point increase in the local unemployment rate causes a reduction of the self-employment period by a factor of 0.91 ( $=e^{\beta}$ ;  $\beta=-0.095$ ). This effect diminishes for very high unemployment rates and turns negative for very high values (peaking around 23% - note that the range varies from 2.6% to 30%). The Sasabuchi test supports this inversely u-shaped pattern (Sasabuchi 1980).<sup>30</sup> Accounting for competing exits shows a similar pattern. Furthermore, we also see that exits into wage work are less affected by an increase in the unemployment rate than exits into unemployment.

We also tested the traditional implementation in which we studied the effect of the local unemployment rate without controlling non-linear effects and without controlling further regional information (not displayed in Table 3, estimations base on model 2). Not controlling for other local characteristics reveals a lower correlation between the local unemployment rate and duration in self-employment; and, for exits into wage work the effect even turns its direction. In detail, leaving all other local covariates out and only focusing on the linear effect reveals that duration are shorten by a factor of  $e^{\beta}=0.993$  according to a percentage change of the unemployment rate (exits into unemployment:  $e^{\beta}=0.98$ ). The effect found for durations until exits into wage work even turns positive ( $e^{\beta}=1.03$ ) which would indicate an extension of the self-employment period with an increase of the unemployment rate.

The effect found for the time-varying unemployment index shows similar pattern to the unemployment rate. As local labor market conditions worsen, the expected self-employment duration decreases. However, according to the estimates displayed in Table 3 (model 4, controlling for other local attributes) the unemployment index is only of a moderate importance for duration. Furthermore, there is no support for an inversely u-shaped correlation between duration and the unemployment index (Sasabuchi test). Exits into wage work are statistically unaffected by changes in the unemployment index. However, this picture of a moderate impact depends on the additional inclusion of the attribute in model 4. Testing linear and non-linear effects related to the unemployment index as the only local information (based on model 2) reveals that the net scaling effect related to a change of one standard deviation in the unemployment index is much higher (-0.41) than the corresponding effect found for the unemployment rate (-0.12).

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<sup>30</sup> The null hypothesis was tested that the relationship of a variable to another increases at low values of an interval and/or decreases at high values.

**Table 3: Scale effects of self-employment duration (without interaction effects)**

variable	all exits		exits into employment		exits into unemployment	
	$\beta$	(se)	$\beta$	(se)	$\beta$	(se)
<b>individual characteristics</b>						
gender (male) <sup>d</sup>	0.127***	(0.01)	0.176***	(0.018)	-0.018	(0.012)
age <sup>n</sup>	0.082***	(0.003)	0.012*	(0.007)	0.096***	(0.004)
age (squared)	-0.001***	(0.00)	0.00	(0.00)	-0.001***	(0.00)
<b>motivation</b>						
short unemployment (< 4 months) <sup>d</sup>	0.284***	(0.009)	0.192***	(0.017)	0.304***	(0.011)
minor employment <sup>d</sup>	-0.264***	(0.019)	-0.119***	(0.037)	0.094***	(0.023)
number of job changes <sup>n</sup>	-0.119***	(0.018)	-0.349***	(0.035)	-0.039*	(0.021)
number of job changes (squared) <sup>n</sup>	-0.016***	(0.005)	0.026***	(0.009)	-0.029***	(0.006)
<b>qualification</b>						
schooling ( $\geq$ high school) <sup>d</sup>	0.111***	(0.01)	-0.077***	(0.02)	0.240***	(0.013)
academic degree <sup>d</sup>	0.051***	(0.013)	-0.084***	(0.024)	0.136***	(0.016)
master craftsman / foreman <sup>d</sup>	0.682***	(0.025)	0.514***	(0.048)	0.730***	(0.031)
management <sup>d</sup>	0.108***	(0.018)	-0.113***	(0.034)	0.172***	(0.022)
commercial background <sup>d</sup>	-0.040***	(0.013)	-0.104***	(0.024)	-0.016	(0.015)
wage premium <sup>d</sup>	0.177***	(0.009)	0.040**	(0.017)	0.183***	(0.011)
small business (< 20) <sup>d</sup>	0.259***	(0.008)	0.207***	(0.015)	0.279***	(0.01)
<b>local labor market</b>						
unemployment rate <sup>n,t,r</sup>	-0.095***	(0.005)	-0.033***	(0.009)	-0.151***	(0.006)
unemployment rate <sup>n,t,r</sup> (squared)	0.002***	(0.00)	0.001***	(0.00)	0.003***	(0.00)
unemployment index <sup>n,r,t</sup>	-0.033***	(0.002)	0.00	(0.004)	-0.040***	(0.003)
unemployment index <sup>n,r,t</sup> (squared)	0.000***	(0.00)	0.00	(0.00)	0.000***	(0.00)
variation index <sup>n,r</sup>	1.100***	(0.097)	1.533***	(0.182)	1.228***	(0.119)
variation index <sup>n,r</sup> (squared)	-0.603***	(0.077)	-0.744***	(0.145)	-0.697***	(0.094)
% vanishing establishments <sup>n,r,t-1</sup>	0.349***	(0.021)	0.309***	(0.04)	0.489***	(0.026)
% vanishing establishments <sup>n,r,t-1</sup> (squared)	-0.011***	(0.001)	-0.009***	(0.002)	-0.016***	(0.001)
east Germany <sup>d</sup>	0.123***	(0.018)	0.237***	(0.035)	0.012	(0.021)
<b>cohort (ref: year 1999)</b>						
three dummy variables <sup>x</sup>	not reported					
<b>profession (ref: trade/manufacturing)</b>						
seven dummy variables	not reported					
constant	1.808***	(0.177)	2.152***	(0.329)	1.943***	(0.212)
ln_sigma	0.211***	(0.005)	0.532***	(0.009)	0.177***	(0.006)
ln_theta	-0.513***	(0.03)	0.572***	(0.064)	0.561***	(0.024)
observations	2,040,855		2,040,855		2,040,855	
exits	89.529		24.901		53.598	
chi2	8980.863		4285.711		7645.934	
BIC	430458.77		183398.74		307596.26	

table reports beta-coefficients based on a lognormal duration model

d stands for a discrete change of dummy variable from 0 to 1; n stands for a numeric variable (metric); r = regional information, t = time varying attribute ; (se) standard errors in parentheses

level of statistical significance: \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

<sup>x</sup> Using 1999 as the reference year, we find that younger start-ups are associated with a higher likelihood of exiting, particularly exiting into unemployment. Note that the cohort has a very strong effect on scaling the time function (see also Figure 1)

source, IEB; own calculations

While the above findings suggest that deteriorating economic conditions reduce self-employment duration, increasing instability (variation) and lower economic prosperity (firm

hazard) have the opposite effect. Again, the results show non-monotonic correlations. In the case of unemployment variation, our findings provide support for the hypothesis of reduced option values for quitting self-employment. Based on the squared effect, we expect a negative marginal effect relating to local instability in duration for values above 0.9 (max=1.32). Unfortunately, the interpretation of this covariate is not a simple procedure. By way of illustration of this complexity, one standard deviation (0.193) similarly prolongs the expected self-employment duration to less than a one year increase in age (equals 1/8 of the standard deviation; not taking into account non-linear correlations). The level of local firm hazard is associated with a diminishing effect in prolonging self-employment duration (taking into account a calculated extremum at 16% and an upper bound of 15.5%). In particular, the high decelerating effect found for exits into unemployment supports the fact that the level of firm hazard in a region strongly associates with reduced competition and/or lower wage work options.

Accounting for the differences of the local labor market conditions in east and west Germany enables controlling for structural macro-economic disparities in Germany. In general, east Germany has higher unemployment rates, lower economic dynamics, and higher proportions of people who receive social transfer payments than west Germany (e.g., Blien and Hirschenauer 2005). As observed by the instability measure (variation index) and the prosperity measure (firm hazard), worse macroeconomic conditions cause an increase in self-employment durations. All else being equal, a shift to east Germany from west Germany causes an increase in duration by a factor of 1.13 ( $=e^{\beta}$ ;  $\beta=0.123$ ). Note that this reveals a different picture than found in the descriptive findings.

#### *Individual characteristics*

Results concerning socio-demographic characteristics and formal qualification are moderately in line with previous findings (e.g., Andersson 2006; Brüderl et al. 1992; Georgellis and Wall 2005). As Table 3 shows, men can be observed as remaining longer in self-employment than women (almost  $e^{\beta}=1.13$  times longer;  $\beta=0.127$ ), self-employment duration in age (peaking around an age of 38) displays an inverse u-shaped pattern, and there is support for the opportunity cost structure of qualification (overall positive effects but negative effects for exits into wage work).

Interesting findings may be observed for individuals who are experienced in a commercial line of work. As discussed above, we expect comparative advantages here for the management of a business which implies a prolongation of self-employment durations. However, the results in Table 3 show a negative correlation with longevity. Exits in general and into employment accelerate in conjunction with a background in a commercial line of work by a time factor of 0.96 ( $\beta=-0.04$ ) and 0.35 ( $\beta=-1.04$ ), respectively. Two explanations can corroborate with this finding:

founders with such a background appear to experience disadvantages in being self-employed and they may face high opportunity costs. However, a focus on the insignificant coefficient for exits into unemployment predominately supports the second interpretation whereby people with an employment background in a commercial field will be pulled out of self-employment.

As can also be seen from Table 3, we find strong decelerating effects for all types of exits related to ‘master craftsmen’ and ‘employment background in small firms’. Specifically, the fact of being a master craftsman<sup>31</sup> or foreman almost doubles the expected duration of exits, in general, and exits into unemployment, in particular, whereas having an employment background in a small firm increases the expected self-employment duration by a factor of between 1.23 and 1.32 (all exits:  $e^{\beta}=1.29$ ;  $\beta=0.259$ ). These findings strongly support the ‘hot-house’-hypothesis, including in the context of self-employment duration as argued above (see also Parker 2009 and 2007). Low division of labor obviously fosters (and/or selects) specific capabilities which are associated with comparative advantages for self-employment positions.

Furthermore, we also find an overall decelerating effect for the attribute ‘wage premium’ (e.g., for all types of exits  $e^{\beta}=1.19$ ;  $\beta=0.177$ ). In accordance with the discussion in section 3.3, we should expect high associated opportunity costs related to this attribute. This should result in decreased durations in the case of exits into wage work which is not found here. However, our findings may reflect the fact that wage premiums tend to disappear on the return to the wage sector (Bruce and Schütze 2004 and Hyttinen and Rouvinen 2008) and/or that the related ‘extra’ productivity is also likely to be transferred to self-employment.

The final set of individual attributes captures motivational characteristics. For the most part the results found here are in line with previous findings and support the observation that pushed individuals (longer unemployment, marginal employment, and increasing job changes) tend to display a shorter duration in self-employment than non-pushed founders. As indicated by the results presented in Table 3 (second panel of attributes), we find very strong effects for the unemployment duration and minor employment positions, which are some of the strongest effects in the scaling of the time function of exits. However, it is worth noting that the included ‘push attributes’ (minor employment and the inverse of short unemployment) not only reduce duration but also accelerate exits into employment. This indicates that individuals who may be pushed into self-employment do not experience much difficulty in re-entering wage work. In addition, given the accelerating effect of job changes on exits (including marginal effects for exits into wage work), our findings provides support for the ‘switching disposition hypothesis’ (Hyttinen and Ilmakunnas 2007).

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<sup>31</sup> Note that master craftsmen (and foremen) in Germany are highly qualified in technical and commercial competencies and are specifically trained to become self-employed. Moreover, master craftsmen in Germany usually operate on markets with high entry barriers.



**Table 4: Scale effects of self-employment duration (including interaction effects)**

variable	all exits		exits into employment		exits into unemployment	
	$\beta$	(se)	$\beta$	(se)	$\beta$	(se)
<b>individual characteristics</b>						
gender (male) <sup>d</sup>	-0.292***	(0.075)	0.2	(0.134)	-0.041	(0.088)
<b>motivation</b>						
short unemployment (< 4 months) <sup>d</sup>	0.319***	(0.073)	0.206	(0.131)	0.443***	(0.085)
Number of job changes <sup>n</sup>	0.263***	(0.052)	-0.08	(0.094)	0.351***	(0.061)
Number of job changes (squared) <sup>n</sup>	-0.015***	(0.005)	0.026***	(0.009)	-0.028***	(0.006)
<b>qualification</b>						
schooling (>= high school) <sup>d</sup>	0.054	(0.075)	-0.422***	(0.133)	-0.065	(0.088)
master craftsman / foreman <sup>d</sup>	0.451***	(0.168)	0.678**	(0.31)	0.304	(0.202)
wage premium <sup>d</sup>	0.123*	(0.07)	0.154	(0.125)	-0.001	(0.083)
small business (< 20) <sup>d</sup>	-0.096	(0.067)	0.003	(0.119)	-0.164**	(0.078)
<b>local labor market</b>						
unemployment index <sup>n, r, t</sup>	-0.033***	(0.002)	0.002	(0.004)	-0.038***	(0.003)
unemployment index <sup>n, r, t</sup> (squared)	0.000***	(0.00)	0.000*	(0.00)	0.000***	(0.00)
<b>interaction terms</b>						
male * unemployment index (ue index)	0.004***	(0.001)	0.00	(0.001)	0.00	(0.001)
schooling (>= hs) * ue index	0.001	(0.001)	0.003***	(0.001)	0.003***	(0.001)
masters' degree / foreman * ue index	0.002	(0.002)	-0.002	(0.003)	0.004**	(0.002)
short unemployment * ue index	0.00	(0.001)	0.00	(0.001)	-0.001*	(0.001)
number of job changes * ue index	-0.004***	(0.00)	-0.003***	(0.001)	-0.004***	(0.001)
wage premium * ue index	0.001	(0.001)	-0.001	(0.001)	0.002**	(0.001)
small business * ue index	0.003***	(0.001)	0.002*	(0.001)	0.004***	(0.001)
note: attributes that are not related to interaction effects are suppressed (see Table 4)						
constant	1.830***	(0.199)	1.934***	(0.365)	1.759***	(0.237)
ln_sigma	0.209***	(0.005)	0.530***	(0.009)	0.174***	(0.006)
ln_theta	-0.490***	(0.03)	0.588***	(0.063)	0.575***	(0.024)
observations	2,040,855		2,040,855		2,040,855	
exits	89,529		24,901		53,598	
chi2	9097.881		4306.051		7748.337	
BIC	430443.46		183480.1		307595.55	

table reports beta-coefficients based on a lognormal duration model  
d stands for a discrete change of dummy variable from 0 to 1; n stands for a numeric variable (metric); r = regional information, t = time varying attribute; (se) standard errors in parentheses  
level of statistical significance: \* p<0.10, \*\* p<0.05, \*\*\* p<0.01  
source, IEB; own calculations

#### *Interaction effects (qualification and labor market conditions)*

Table 4 presents the results obtained by controlling for interaction effects. As the results show, males display greater elasticity in reacting to a negative economic development than females (prolonging self-employment duration). Similar effects also appear for people with an employment background in small firms. As already argued, the results show that the higher the qualifications (higher education, master craftsman, premium earnings) in conjunction with an (relative) increase in labor-market pressure, the longer the expected self-employment duration. However, the statistical significance of the coefficients concentrates on exits into unemployment

while exits in general and exits into employment are less likely to be affected by the interaction of local characteristics and individual attributes.

We also tested whether this picture changes if we also control the interaction for the nonlinearity of the unemployment index (not displayed). Overall, the results do not change substantially but we find that higher education and wage premium have a decreasing marginal negative correlation with duration (insignificant for exits into wage work).

### 6.3 Survival estimates

Combined linear and non-linear effects are not easy to interpret in terms of accumulated net effects. In addition, what we do not see from the results reported in Tables 3 and 4 are concrete estimates for expected durations or for survival. Therefore, Figure 2 enables the more tangible understanding of the results: the graphs show the cumulative linear and non-linear effects of changes in the local labor market for the survival function. The graphical assessment covers different measures of the local labor market conditions and is based on the estimates reported in Table 4 (holding all other covariates fixed at their mean). All graphs reflect the interaction between time dependency and the scaling effect of the covariate.<sup>32</sup> It should be noted that for technical reasons, the survival axes differ in displaying the range of the survival functions.

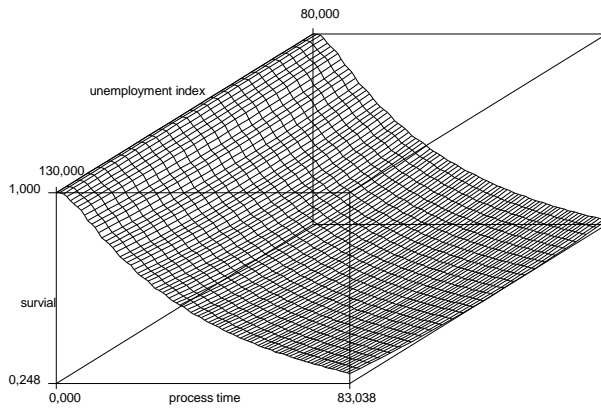
The picture of a (relatively) low correlation between external conditions and survival chances found for the unemployment index and the variation changes for the unemployment rate and local firm hazard, where we see much stronger accumulated net effects (lower graphs). In particular, survival decreases with local unemployment (graph three) whereas the net correlation between firm hazard and survival does the opposite (graph four). For both measures, we find a predominant marginal decrease of changes in survival instead of an inflexion. In terms of specific figures, an unemployment rate of 5% (which is at the lower end of the measure) is associated with a survival of 89.2% in  $t=12$  and 64.0% in  $t=36$ . For higher values of the unemployment rate (e.g., 17%, equals the upper quartile of the measure), we expect survival chances of around 77.2% in  $t=12$  and 44.6% in  $t=36$ .

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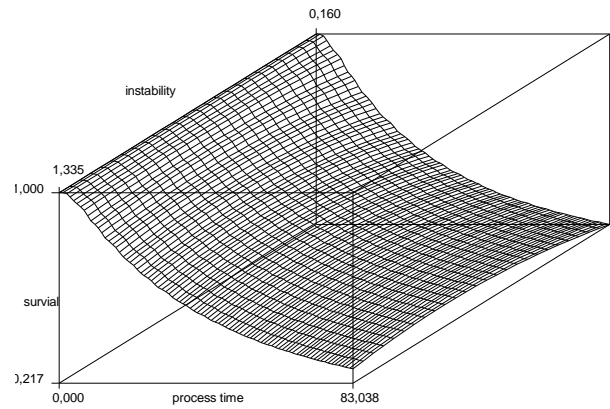
<sup>32</sup> Unfortunately, the reported estimates do not accurately account for the time-varying nature of the measures because the simulation assumes fixed values until  $t$ .

**Figure 2: Survival estimates**

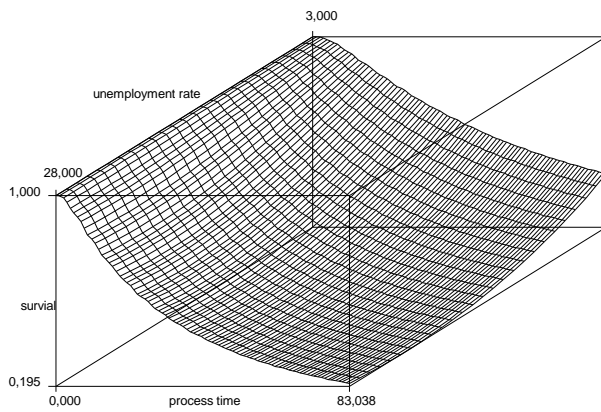
1) Survival and change of local unemployment (index)



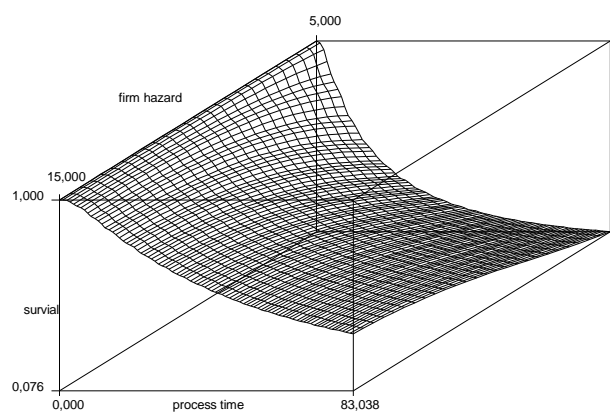
2) Survival and local employment instability (unemployment variation)



3) Survival the level of local employment (unemployment rate)



4) Survival and local economic prosperity (firm hazard)



source: IEB; own calculations

The first graph (top left) informs about the effect of the unemployment index on survival. What we find is only a slight difference between high and low values of the unemployment index in scaling the time function of survival. In  $t=48$ , we observe a survival rate of almost 42.6% for an index value of 80 and a survival rate of 45.3% for an index value of 130. The accumulation of both effects shows that the unemployment index plays only a minor role in explaining survival. Similar results can be found for the accumulated net effect of local employment instability (see second graph, top right). The related survival chances vary between 46% and 57% in  $t=36$  and between 22.7% and 31.8% in  $t=80$ .

The most significant effect is detected for the measure of local firm hazards (share of vanishing establishments) where we find a strong difference between the low and high values of firm hazard for survival. A linear decrease can almost be observed for high values of firm hazard and a strong compressed time dependency for low values. In  $t=12$  we expect survival chances of almost 68.6% conditional on a share of vanishing firms of 7%. This decreases to 34.6% in  $t=36$  and 26.1% in  $t=48$ . In a local market with 13% firm hazard, survival increases to 86.7% in  $t=12$ ; 59.3% in  $t=36$  and 49.7% in  $t=48$ .

## 6.4 Robustness checks

Spatial structures, which have not been considered up to now, may harm the estimates because of clustered observations and spatial correlation. First, in addition to the results reported in Tables 3 and 4, we also used cluster-adjusted standard errors to account for the potential correlation between observations within the same local labor market (see Moulton 1990).<sup>33</sup> However, the results do not substantially differ from the reported results (not displayed). Second, spatial correlation cause neighborhood effects which means that measuring labor market conditions in Region 1 adjoined to Regions 2 to 4 does not precisely reflect labor market conditions relevant for the individuals in Region 1. Taking such neighborhood effects into account, all estimates were also carried out using weighted regional information. We used the commuter matrix to weight local information.<sup>34</sup> Again, the reported results in Table 3 and 4 do not substantially differ from those related to the weighted regional information (not displayed).

Finally, several studies report strong gender differences and thus investigate the determinants of self-employment duration separately for males and females (Williams 2000; Georgillis and Wall 2005; Wagner 2007). Following this research, gender-specific effects were analyzed as well (not displayed). A Chow test supports that the coefficients of the whole population vary statistically significant across gender for all types of exit (Chow 1960). However, related to single attributes differences between males and females are less pronounced in terms of the magnitudes of the coefficients. We found that higher education seems to be relevant for females concerning exits in general and into unemployment while it has a higher impact on quitting into wage work for males. Similar effects are found for a college degree. Moreover, being experienced in a management position matters to larger extend for males in quitting self-employment than for females. Obviously, opportunity costs seem to be more important for males than for a female. This indicates different findings than those reported in William (2000).

## 7 Summary and conclusions

This study focuses on examining local labor market conditions and individual attributes in determining the stability of new self-employment entries. In particular, we concentrate our investigation on how external changes interact with individual differences in scaling the duration in self-employment. The data used for this inquiry was gathered from the Federal Employment Service

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<sup>33</sup> The identification of regional clusters refers to Eckey et al. (2007 and 2006) – see also Table A.2 in the Appendix. The use of regional data usually causes problems in relation to spatial inter-correlation.

<sup>34</sup> The commuter matrix is used to construct a weighted regional measure according to the interdependence of the local labor force. Therefore, the more important the labor market of a neighboring region, the higher the weight of its (e.g.) local unemployment rate for the calculation of the weighted unemployment rate for the region in question.

(register based data) and capture a population of promoted founders, who were unemployed before starting their business, entering self-employment between 1999 and 2002.

While most of the descriptive findings support previous results, our findings show that almost 56% of all individuals quit self-employment during the observation period of 83 months, indicating a lower share of survivors than found in previous studies. Furthermore, we find that 60% quit self-employment by exiting into unemployment and 28% who entered into new employment directly following their self-employment state. This is in line with Oberschachtsiek (2008) but contradicts the findings of Cueto and Mato (2006), Johansson (2000) and Taylor (1999) which show an inverse relation between exits into wage work and into unemployment. In addition, our results show great dynamics in the post-exit employment positions, which has been unreported in previous studies.

The first part of our multivariate investigation focuses on the importance of including local labor market conditions. We find that the effect of local labor market conditions on duration in self-employment is only roughly captured by the local unemployment rate. In particular, most improvements of the entropy relate to information that captures economic changes. This is in line with previous findings (Tervo and Haapanen 2009) and supports the theoretical discussion. We also find that controlling for human capital attributes reveals the greatest improvement in describing self-employment longevity while the interaction of local information and individual characteristics is only of lower importance.

In a second part, we tested single attributes. Theoretically, potential effects will be ambiguous concerning direction and magnitude of the correlation with duration in self-employment for most of the included characteristics.

Our results show that local labor market conditions have a rather complex impact on self-employment longevity. All local labor market attributes reveal a diminishing correlation with duration in self-employment - and partly inverse marginal effects. We also find that not controlling for squared effects partly reveals contrary findings for the effect of the unemployment rate on duration. In particular, this may explain ambiguous findings in previous studies (Johansson 2000; Taylor 2000). We also find that high or increasing local unemployment rates cause more unstable self-employment periods. In contrast, increasing local firm hazard or local instability in wage work positions extend self-employment episodes. Therefore, our findings indicate that local unemployment is associated with a higher reduction in self-employment income than in the potential income in wage work. Simultaneously, the results show that a reduction of the option value of wage work (if wages become more risky) relatively favors income position in self-employment.

On the individual level, we find that qualification enhances duration in general but it also accelerates exits into wage work positions. We interpret this as the effect of opportunity costs. Furthermore, we find that 'short periods of unemployment', 'employment experience in small

firms', 'being a master craftsman' and 'having received a wage premium' are related to an overall extension of self-employment periods. Therefore, these attributes seem to be associated with comparative advantages in self-employment. In particular, our finding that 'employment experience in small firms' enhances duration in self-employment is the first sign for evidence to support the theory that the 'hot-house' hypothesis also applies in the context of self-employment success (see Blanchflower and Meyer 1994; Wagner 2004; Parker 2007). Obviously, low division of labor fosters (and/or selects) specific qualities which are of higher advantages for self-employment than for wage work. Furthermore, our results show that a commercial background relates to comparative disadvantages for self-employment positions mainly affected by high opportunity costs. We find that re-employment risks mainly increase due to high numbers of job changes which support the 'switching disposition' hypothesis as suggested by Hyytinen and Ilmakunnas (2007).

In addition, even if less pronounced our results reveal that individuals significantly differ in reaction to changes of external conditions. Males and qualified people seem to face a higher decrease of option values for wage work in the increasing absence of external employment options and remain self-employed longer than their counterparts. However, statistical significance is concentrated on exits into unemployment. Accordingly, robustness checks show that qualification are less important for females in quitting into wage work, which indicates that the exit behavior of females is less affected due to opportunity costs. Partly, this is in conflict to the findings of William (2000) who argued that penalties due to self-employment in returns due to experience mainly arise for women.

Based on these findings several implications can be derived. First of all, political attempts to promote self-employment out of unemployment may gain traction if regional agents consider local economic conditions. In particular, in regions with unemployment rates below 20% changes in the economic conditions matter for survival and these changes mainly reduce survival chances of the less qualified. However, the study shows a quite complex pattern of the importance of external economic conditions. Therefore, further research that points to the importance of regional conditions in self-employment exits is needed. On the individual level our results suggest that fostering self-employment may gain efficiency when focusing on training broad skills or when focusing on individuals with such competencies. However, it would be interesting if this finding differs across other populations of self-employed individuals (e.g. migrants, people not starting out of a position of unemployment).

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## 9 Appendix

**Table A.1: Macro-economic conditions and self-employment hazard - selected findings**

study	data	macro-economic variables	
		labor market	other
Taylor (1999)	British Household Panel Survey; two cohorts: entries in 1979 and 1991; n = 1,361 (910 male, 451 female) covering a period with high unemployment following an inversely u-shaped pattern	national unemployment rate at start-up: all exits: + voluntary exits: + involuntary exits: :n.s.	/
Carrasco (1999)	Spanish Family Expenditure Survey (ECPF); changes between 1998 und 1991; n = 821 covering a period with consistently very high unemployment	national unemployment rate at start-up: all exits: + voluntary exits: + involuntary exits: n.s.	/
Johansson (2000)	micro data of the 'Labor Employment Statistics' (LES) Finland; entries between 1987 and 2000; n = 4,192 Spells covering a period with increasing unemployment, coming from a low level	regional annual unemployment rate all exits: - voluntary exits: - involuntary exits: + (f)	/
Van Praag (2003)	US National Longitudinal Survey of Youth (NLSY); entries between 1985 and 1989; n = 271 covering a period with moderate unemployment following a declining trend	national unemployment rate at start-up: n.s.	business failure rate each year and industry: +
Tervo and Haapanen (2009)	micro data of the LES, Finland; entries in between 1987 and 2000; n (random sample) = 12,661 individuals see Johansson (2001)	regional annual unemployment rate: n.s. annual changes of the ue-rate: +	/
Andersson (2006)	process generated data, Sweden; entries in 1991; annual panel; n = 20,217 covering a period with moderate unemployment, with a decreasing trend	regional unemployment rate: all exits: + voluntary exits: n.s. involuntary exits: +	self-employment density: all exits: - voluntary exits: - involuntary exits: -
Cueto and Mato (2006)	survey data; promoted entries out of unemployment between 1996 and 2000; Spain; n = 848 covering a period with very high unemployment, strongly decreasing but still high	national quarterly unemployment rates in the year of the start up: all exits: - (f) voluntary exits: - involuntary exits: n.s.	/

explanation: + (-) indicates a positive (negative) correlation between the attribute and the exit probability  
(f) indicates significance only for the female population  
n.s. stands for not significant

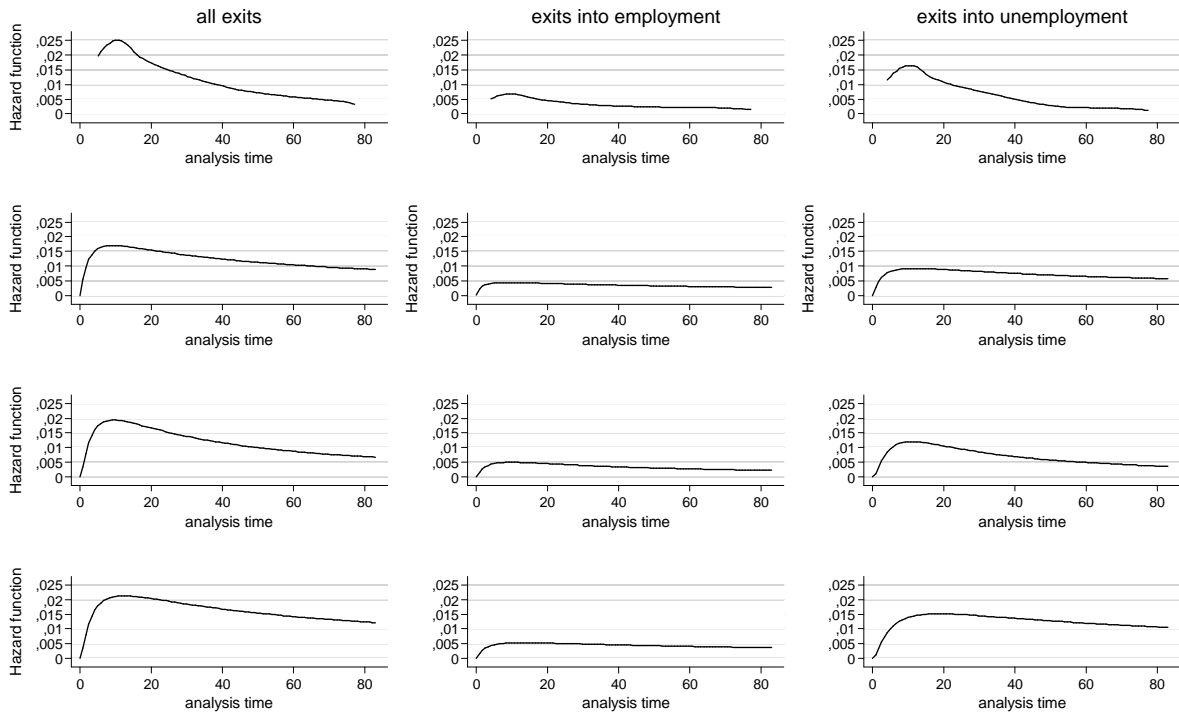
## Table A.2: Definition of the variables

gender (male)	Sex is male. Source: Employment History.
age	Age of the founder at the beginning of the self-employment episode. Source: Employment History.
schooling (>= high school)	Schooling equals high school degree or higher (Germany: 'Abitur' or 'Fachabitur'). Source: Job Search Register.
academic degree	The founder holds an academic diploma (university or college). Source: Job Search Register.
master craftsman / foreman	The founder has worked as a crafts master or foreman (job position) in his or her last employment episode before starting the business. Excluded are employment episodes with a daily income lower than 5 Euro or lasting less than 60 days (valid employment episode). Source: Employment History.
management	The founder worked in a management position in the last employment episode before starting the business. Source: Job Search Register.
commercial background	The founder is experienced and (formally) trained in a commercial profession. Source: Job Search Register (apprenticeship information); Employment History (using the two digit classification of a selected set of professions; experience).
short unemployment	The unemployment duration before setting up the business is less than 3.5 months (difference between last employment and beginning of the promoted self-employment episode; missing values are imputed). Source: Employment History
number job changes	Number of distinct two-digit classified professions during the last two years before starting the business. Source: Employment History.
minor employment	Founder worked in a minor employment during the last valid employment episode before setting up the business. Source: Employment History.
wage-premium	Identifies if a founder earned 1.66 times more than the expected monthly wage income in the last valid employment episode. The expected income is a regressed function of the income and a selected set of covariates (e.g., age, schooling, job changes, gender, job position, size of the establishment) conditional on the type of profession and part- or full-time status. Source: Employment History.
size of establishment / small business	Size of the Establishment: modus of the number of employees of the establishments during the last five years before setting up the business. Only those employment records are included that last for more than 3 month with an income greater than zero. Source: Establishment History Panel. Small Business: The founder has usually worked (modus of the last five years) in establishments with less than 20 employees. Source: Establishment History Panel.
unemployment rate (UER)	Monthly unemployment rate of the local labor market district. This information is merged with the micro data after splitting the dataset into three-month periods. Berlin is treated as one region (un-weighted average). Source: Employment Statistics.
unemployment index	Time-varying covariate that covers a normalized unemployment rate relative to the starting point (index = $UER * 100 / UER$ ). Source: Employment Statistics.
variation index	Captures the variation of the monthly unemployment rate for each local labor market district. The index relates to the square root of the squared mean error of a time series estimation. Source: Employment Statistics.
share (%) of vanishing establishments (local firm hazard)	Identifies the share of establishments that are found in t-1 but do not exist in t in the local labor market district. Source: Establishment History Panel.
cohort	Represents the year in which the founder set up the business. Source: Participation in Measure Register.
profession	Distinguishes seven clusters of professions based on a two-digit job classification related to the last valid employment episode. Source: Employment History.
exit	Equals one if there is a non-self-employment episode after starting the business (beginning of the promotion). Source: all sources of the IEB. The identification distinguishes between a) employment (wage work with notification to the social security system), b) unemployment (with and without unemployment benefits) or participation in measure, and c) other (e.g. minor employment). Before identifying these spells, the data set was reorganized to summarize different types of spells.
duration of self-employment	The duration of self-employment is the difference between the beginning date of the promotion (start-up of the business) and the date of the first non-self-employment episode after starting the business. Censoring refers to 31 Dec. 2005.

**Table A.3: Tables of correlations**

	(1 a)	(2 a)	(3 a)	(4 a)	(5 a)	(6 a)	(7 a)	(8 a)	(9 a)	(10 a)	(11 a)
(1 a) age	1										
(2 a) schooling (>= high school)	0.1123	1									
(3 a) short unemployment (< 4 months)	-0.075	0.0058	1								
(4 a) commercial background	0.0022	-0.0442	-0.1108	1							
(5 a) number of job changes	-0.077	-0.0201	0.1179	-0.0436	1						
(6 a) minor employment	0.1503	0.4889	-0.0023	-0.0334	-0.0219	1					
(7 a) academic degree	0.0101	-0.0553	0.0587	-0.0169	-0.0144	-0.018	1				
(8 a) master craftsman / foreman	0.1325	0.1325	0.0062	-0.0167	0.0462	0.0913	-0.0154	1			
(9 a) management	0.0543	-0.0172	0.0043	0.0053	-0.0042	-0.107	-0.0707	0.1067	1		
(10 a) wage premium	0.0488	0.0597	0.017	-0.0384	0.0467	0.0391	0.0196	0.054	0.0548	1	
(11 a) small business (< 20)	-0.0809	-0.0831	0.0853	0.0093	0.0475	-0.0677	0.038	-0.0252	-0.0347	0.0206	1
	(1 b)	(2 b)	(3 b)	(4 b)	(5 b)	(6 b)	(7 b)	(8 b)	(9 b)	(10 b)	
(1 b) male	1										
(2 b) schooling (>= high school)	-0.0713	1									
(3 b) wage premium	0.0221	0.0597	1								
(4 b) primary sector	-0.0146	-0.0284	-0.0159	1							
(5 b) trade/manufacturing	0.3436	-0.1924	-0.0342	-0.1089	1						
(6 b) commercial/ administration	-0.2067	0.1401	0.0655	-0.098	-0.5785	1					
(7 b) transport/security/post	0.1199	-0.1	-0.0294	-0.0396	-0.2341	-0.2105	1				
(8 b) medical/care	-0.1621	0.087	0.0015	-0.0262	-0.1546	-0.139	-0.0563	1			
(9 b) education/social welfare	-0.1264	0.1876	0.0034	-0.0306	-0.1808	-0.1626	-0.0658	-0.0434	1		
(10 b) else profession	-0.1526	0.0061	-0.0191	-0.0415	-0.2453	-0.2207	-0.0893	-0.059	-0.069	1	
	(1 c)	(2 c)	(3 c)	(4 c)	(5 c)	(6 c)	(7 c)	(8 c)	(9 c)	(10 c)	
(1 c) unemployment rate	1										
(2 c) unemployment rate (sq)	0.9849	1									
(3 c) unemployment index	0.0472	0.0394	1								
(4 c) variation index	0.368	0.3741	-0.032	1							
(5 c) firm hazard	0.7493	0.7074	0.2346	0.0173	1						
(6 c) east Germany	0.7801	0.7834	-0.0914	0.5108	0.4892	1					
(7 c) year 1999	-0.0017	-0.0037	-0.3035	0.0213	-0.1272	0.0236	1				
(8 c) year 2000	-0.0123	-0.0099	0.0092	0.0067	-0.0387	0.0116	-0.3744	1			
(9 c) year 2001	0.0116	0.0136	0.1904	-0.0017	0.0558	0.0057	-0.3395	-0.3361	1		
(10 c) year 2002	0.0032	0.0007	0.1222	-0.0283	0.1213	-0.0435	-0.3281	-0.3248	-0.2946	1	

**Figure A.1: Assessment of the model selection**



source: ieb, own calculations  
 graphs in the following order (top to bottom):  
 non-parametric smoothed hazard function, hazard function without frailty, unconditional and conditional hazard functions