Start-up grants and self-employment duration

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Abstract

The aim of this study is to analyze the survival of the self-employed who have received start-up grants and compare them to non-grant recipients. The methods of duration analysis are used to investigate the survival of self-employment and its components. The results indicate that the duration of start-up supported firms is clearly longer than that of non-supported start-ups. Human capital from prior experience and assets strongly influenced the survival of supported start-ups, whereas social capital was less significant than for non-supported start-ups. The better survival of supported firms can be explained by the assessment process and the training prerequisite for grants rather than the relatively small and short financial support. However, the supported entrepreneurs ended up more likely to become unemployed after failure, whereas the others moved on to activities outside the labour force.

JEL codes: L26, L53, C41, H81

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1 Introduction

Self-employment has become a significant source of economic and job growth globally (see e.g Minniti et al., 2005). In Finland, the number of self-employed persons has shown a steady increase since 1994, following a period of decline (Ministry of Trade and Industry, 2006). Many hopes and expectations are associated with this development. New firms are expected to create new jobs, foster growth and development etc. These expectations are fulfilled only if sufficient number of newly founded firms survives. The empirical evidence reveals that many businesses are born to die or stagnate very young (Storey, 1982; Burns, 1989). 30 to 40 per cent of start-ups do not survive even the first two years (Scarpetta et al., 2002).

Simultaneously, self-employment subsidization has emerged as a key policy tool (Dreisler et al. 2003; Glancey and McQuaid 2000). Subsidies are generally aimed at assisting new firms, as they have most usually been found to suffer from the financial gap caused by market failure (Glancey and McQuaid, 2000). The existence of small business support systems such as start-up grants[1] is premised on the idea that many potential entrepreneurs cannot obtain start-up money, and thus their aim is to fill or reduce the financial gap to more wealthy entrepreneurs. As such, grants are assumed to increase the supply of entrepreneurship (Holz-Eakin et al., 1994). Their purpose is to help entrepreneurs through the critical seed and start-up phases. It is questionable whether the supported start-ups truly lack finance. The financing authorities may not identify all personal sources of finance for each applicant firm (Scholtens, 1999; Parker, 2004). In that case, the start-up grant is additional finance for the firms or may even replace other external finance such as bank loans.

The issue of the survival of start-ups has attracted increasing interest before (e.g. Bates, 1990; Holtz-Eakin et al. 1994; Taylor, 1999; Falter, 2001; Rissman, 2006; Georgellis et al., 2007). Brüderl et al. (1992) examined the evidence obtained in several previous studies on the factors that affect the survival probability of firms in general. They condensed those results into three categories: (1) the individual characteristics of the founder; (2) the attributes, structural characteristics, and strategies of the new business itself; and (3) the conditions characterizing the environment of the new firm. Nevertheless, only a few previous academic studies have dealt with the impact of start-up grants on the duration of self-employment (see however, Meager, 1996; Del Monte and Scalera, 2000; Pfeiffer and Reize, 2000). Del Monte and Scalera (2000) argued that a comparison between the duration of supported and non-

supported firms is not an appropriate criterion for appraising subsidy programmes, since the set purpose of the subsidies is to reduce the gap between firms that need subsidies and those that do not. This is also the guideline in the Finnish start-up grant system. However, this selection bias can be controlled with a proper evaluation method such as propensity score matching used here. Pfeiffer and Reize (2000) found that the survival rate of subsidized firms was lower. In Finland, prior research on start-up grant entrepreneurs is based on the follow-up surveys and evaluations produced by labour force authorities (e.g. Sääski 1994; Lehto and Stenholm, 2001; Stenholm, 2006) and research institutes (e.g. Rantala, 1995; Hämäläinen, 1999). In these, the research focus has mostly been on providing a general description of start-up entrepreneurs or analyzing the effect of start-up grants on employment.

The aim of this paper is to analyze the start-up grants disbursed in Finland during the period 1988–2001. The study focuses on three empirical aspects. Firstly, it compares the survival of supported and non-supported start-ups and analyzes whether grants have reduced the financial gap. Secondly, it identifies the characteristics that predict the likelihood of survival for supported firms and discusses the differences in comparison to non-supported firms. In addition, the relevance of determinants based on human capital, social capital and organizational ecology theories is tested. This approach of survival chances by Brüderl et al. (1992) is developed in this study. Individual characteristics constitute a theoretical basis for empirical examination. The founder is the key to a firm's survival, but cannot provide a complete picture of the essential features of survival (Stearns et al., 1995). Thus, organizational and environmental factors are taken into consideration as control variables. Lastly, as it is reckoned that self-employment does not necessarily end due to failure, the supported start-ups' reasons for exiting are analyzed. Overall, the purpose is to offer an extensive analysis of supported start-ups and their survival. The novelty of this paper is in its large data and long time period along with methodologically improved approach. The supported start-ups are followed for period of 14 years and compared to non-supported ones, whereas prior studies tend to be based on small samples and very short time periods, and have lacked appropriate control groups. Propensity score matching is used in order to form comparable treated and non-treated groups in terms of factors that affect outcomes.

The next section of the paper describes the theoretical aspects of start-up duration and findings from previous studies. Section 3 presents the data set and choice of variables, as well

as the hypotheses. Section 4 overviews the econometric methodology. The results are reported in section 5, and the paper ends with conclusions and policy recommendations.

2 Theoretical aspects of start-up duration

Jovanovic (1982) put forward a framework that emphasizes the characteristics of the entrepreneur as a main explanation for a firm's success. He showed that individuals are able to obtain information on their entrepreneurial skills only through actually being entrepreneurs. They start new firms on the basis of a vague sense of expected probability, but only learn their true abilities once the businesses are established. As a result of this information, entrepreneurs modify their behaviour and expectations over time using a Bayesian rule (Santarelli and Vivarelli, 2002). By revising the ability estimates upwards, entrepreneurs are able to expand their businesses and survive, whereas if they revise them downwards, their businesses tend to wither, leading finally to their exit from the industry. This "try and see" approach of new firm entry and behaviour is consistent with strong empirical evidence (see Geroski, 1995; Hart and Oulton, 1996; Santarelli and Vivarelli, 2002)

It has been suggested that human and social capital reflect the sub processes of entrepreneurship, i.e. the discovery and exploitation of entrepreneurial activities (Shane and Venkataraman, 2000). The concept of human capital has long been recognized to correlate with a firm's profit through increased productivity (Mincer, 1974; Becker, 1975; Bates, 1985). The human capital theory holds that knowledge augments the cognitive abilities of an individual, thus enhancing his or her productivity. Traditional human capital research has focused on the effect of earnings. Brüderl et al. (1992) were the first to elaborate on the mechanisms through which human capital affects survival chances. In terms of survival, an entrepreneur's higher productivity means that he or she is more efficient in the production process or in attracting customers. Higher human capital improves several abilities needed in business such as risk-awareness and market prospects comprehension. In addition, human capital has an important role for lenders in assessing potential borrowers. Human capital and its easily observable indicators act as signals of profitable projects for financiers. Thus, entrepreneurs with high human capital are less likely to suffer from debt-rationing. In fact, Cressy (1996a; 1996b) suggests that the influence of assets on survival is explained endogenously by human capital.

Social capital is theorized to supplement human capital in influencing a firm's success. The central idea of social capital theory is that social structures, networks and memberships constitute valuable resources in business (Portes, 1998; Davidsson and Honig, 2003). Thus, the extent and effectiveness of social relations are likely to modify the effects of human capital (Loury, 1987; Coleman, 1988; 1990). Social networks may be formed through family, community or organizational relationships, and they can occur at the individual level or the organizational level (Davidsson and Honig, 2003). The individual ties are a focus of this paper, because the firms studied here are small and mainly established for self-employment. Through networks, their members can gain privileged access to information and to opportunities. From an entrepreneurial perspective, networks can facilitate the discovery of opportunities, as well as the identification, collection and allocation of scarce resources (Uzzi, 1999). Networks may also provide considerable resources especially concerning incomplete information and weak markets (Leff, 1979). Davidsson and Honig (2003) demonstrated that social capital is important in predicting successful entrepreneurship.

The theory of organizational ecology identifies several other factors affecting mortality, including organizational strategies and environmental forces. As conceptualized by Hannan and Freeman (1977; 1989), this theory focuses on explaining the rates of birth, growth, and mortality of organizations in any given environment. As such, it is closely associated with survival and offers a background framework regarding the organizational determinants of duration. Carroll (1984) distinguished between three levels of analysis in organizational ecology: the organizational, the population and the community level. However, there are no clear-cut predictions on which strategy or environment is best for newly founded firms (Brüderl et al., 1992). Their advantages are very much individual for each firm. Here, the focus is on the entrepreneur; the main characteristics of the organization are controlled for, but their impact is not fully explored.

3 Data and variables

3.1 Data on start-ups

In Finland, a nationwide system of start-up grants was launched in 1988. Only slight changes have been made to the regulations and size of grants over time. Grant size is tied to the size of

unemployment benefit, and has averaged at 500 – 650 euros per month for a maximum of 10 – 15 months. A grant is awarded on the condition that the firm could not be started without it (Ministry of Labour, 2005). In 1988, the total number of start-up grants disbursed was below 3 000, which accounted for about 14 per cent of all new firms. Due to the economic recession, the share of start-up grants more than doubled from 1990 to 1993 and 1994. Since then, more or less 10 per cent of new firms annually have been start-up grant recipients. This share has however been on the decrease since 2000 (Statistics Finland, 2004). Decisions on start-up grants are made by the Employment Office, which also consults third-party experts to evaluate the applicant as a potential entrepreneur and to determine whether the business concept is viable. The start-up grant applicant must have entrepreneurial experience or training. The Employment Office provides entrepreneurial training which overviews the preconditions for entrepreneurial activity, the principles and demands of business activities, and the properties of a successful entrepreneur. The training also furnishes participants with basic skills in accounting, marketing, taxation and the risks of entrepreneurship (Stenholm, 2006; Ministry of Labour, 2005).

The present analysis is based on longitudinal data files collected and maintained by Statistics Finland. Panel data are provided for a 7 per cent random sample of the permanent residents of Finland in 2001. The data set includes a measure of variables merged from the Longitudinal Census File, the Longitudinal Employment Statistics and other registers from the period 1970-2002. Thus, the past experience of individuals can be elicited from the files. In addition to variables based on the personal, regional and workplace characteristics of individuals, the particulars of their spouses and parents are included in the data set. Information on the receipt of start-up grants comes from the Employment Statistics published by the Ministry of Labour. The sizes of the grants are not observable in the data set. However, the regulations do not allow substantial variations in grant sizes.

In this paper, the sample of persons who entered into self-employment[1] since the launch of the system in 1988 up to 2001 is used. Self-employed persons in the agricultural sector are excluded from the sample due to the special nature of agricultural entrepreneurship (see e.g. Blanchflower, 2000; Parker, 2004). Self-employed persons in the Åland region are also excluded from the data set, as none of them received a start-up grant during the period. A single individual may have had several periods of self-employment during the study period. In this sample, the share of persons with more than one spell of self-employment was 16.4 %. The majority of these serial entrepreneurs had two (87.2 %) or three spells (11.7 %). The personal data is therefore converted into self-employment spell data, which comprises 21 017 self-employment spells, of which 2 852 (13.6 %) were supported by public start-up grants.

The data set is annual and prospective. The duration data are grouped into discrete intervals of time (years), although the underlying transition process occurs in continuous time. The last year of observation for surviving or failing is 2002. For this reason, the data is right censored and includes both spells completed and spells not completed by the end of 2002. The maximum length recorded depends on the cohort, i.e. it is 14 years for the 1988 cohort, 13 years for the 1989 cohort etc.

3.2 Variables and descriptive statistics

The data set includes rich information about self-employment spells that enables comprehensive analysis. It also contains information about non-supported spells, which was missing from most of the earlier studies. The factors used in the duration modelling can be grouped into two main categories in addition to the duration and year dummies. These categories are the individual characteristics of the founder and the organizational and environmental characteristics. This categorization is refined from the three category classification that Brüderl et al. (1992) concludes to be influential in survival probability.

[1] The concept of self-employment directly follows from the statistical definitions used by Statistics Finland (see Statistics Finland, 2001). The data on employment status are based on the person's national insurance status and type of income and thus describe whether a person is paid-employed, non-employed or self-employed. The latter are defined as persons who have a self-employed person's pension insurance during the last week of the year, and whose income from entrepreneurship exceeds a specified level of earnings. This threshold is set inferentially using data from the Labour Force Survey.

Individual characteristics are grouped into human and social capital resources represented by several variables of personal and family characteristics, education and prior experience, which indirectly allow us to study the influence of human and social capital (cf. Davidsson and Honig, 2003). Human capital can be divided into general and specific human capital, both of which are crucial in the self-employment context (Becker, 1975). Education and work experience measured in years or levels represent general human capital being the main components of human capital theory (Mincer, 1974). Age is generally interpreted as a proxy for accumulated informal human capital. Older persons in self-employment will also have accumulated more assets in order to maintain a viable business (Evans and Jovanovic, 1989). Older entrepreneurs are more likely to exit self-employment, which is understandable as they are closer to retirement age. The age of the entrepreneur typically has a positive effect on the probability of survival, although the effect may be non-linear (Cowling, 2006). Pfeiffer and Reize (2000) have supported this phenomenon by showing that the 35 to 45 - year - old groups of start-up entrepreneurs survive longer than the others.

Formal human capital, namely education, is described by educational level, educational field and a variable indicating whether the self-employed individual has a qualification in the firm's field of operation. The latter is formed by matching the individual's education with the firm's industrial sector according to the skills that are publicized as being taught within the educational field. The evidence relating to education shows mixed results. According to Bates (1990), highly educated entrepreneurs – those with four or more years of college – are the most likely to create firms that remain in operation. Bates (1998) and Cowling (2003), instead, found the effect of education to be negative.

In the context of self-employment, specific human capital is distributed as industry-specific and entrepreneurship-specific human capital (See e.g. Young & Francis, 1991; Brüderl et al., 1992). Industry-specific experience increases productivity, as the main activities of the industry have already been learned. It may also yield knowledge about potential niches in business. Entrepreneur-specific human capital can best be obtained through self-employment experience, although some entrepreneurial skills may also be achieved through special entrepreneurial training (e.g. Brüderl et al., 1992; Firkin, 2003). Another type of entrepreneur-specific human capital is experience as a manager or director. Those with managerial

experience in paid-work may also have better skills for running businesses of their own. Variables of prior experience concern whether the self-employed person has been employed, unemployed, in paid-work in the firm's field of operation and whether he or she has had managerial experience and self-employment experience before the particular self-employment spell. Work experience in the same industry represents the industry-specific human capital of the self-employed individual, whereas earlier experience of self-employment indicates entrepreneur-specific human capital. They have both been found conclusively to have a positive effect on survival (Brüderl et al., 1992; Taylor, 1999; Cowling, 2006). More general labour experience has also been found to increase survival possibilities in a number studies (eg. Cowling, 2006; Cueto and Mato, 2006). Having been unemployed, however, is supposed to have an opposite impact, although informal human capital such as special training may be increased especially during unemployment. Persons with managerial experience in paid-work tend also to have better skills for running businesses of their own (Brüderl et al., 1992).

Social capital is determined utilizing variables of the family network, which theoretically yield socially important relationships. The variable of parental self-employment (current or previous) has been shown to be influential in a number of studies on entrepreneurship (Davidsson and Honig, 2003). In this study, the effects for mother and father are investigated separately. Lentz and Laband (1990) found that self-employed parents affect the self-employment of their progeny. This influence may be mediated through assets, talents or attitude. Wealthier parents can assist their sons and daughters in self-employment either by lending money or through inheritance (Uusitalo, 2001). Self-employment of spouse is assumed to have similar kind of influence on person's social networks. Parents' education is also supposed to indicate stronger social business networks. In addition, marital status is considered to be an important measure of social capital (Honig, 1998). Being married is more likely to increase the probability of survival (see eg. Cueto and Mato, 2006)

Female entrepreneurs have been found to be at a likely disadvantage in terms of their opportunities to accumulate human capital relevant to self-employment duration through wage employment (Boden et al., 2000). Male entrepreneurs have been found to survive longer (see e.g. Bates, 1998; Bosma et al., 2004; Pfeiffer and Reize, 2000). Having children may affect working preferences, although the direction of the effect is not clear (Holz-Eakin et al., 1994). Gender and having children are therefore included in this study as controls.

Organizational and environmental characteristics are drawn from organizational ecology and they describe the firm firms itself and its environment. Smaller companies are more vulnerable than larger companies, as density increases competition. Size is related to financial resources, which are assumed to be larger and more diversified in greater companies. Here, income and home-ownership indicate the private financial assets of the entrepreneur. Prior annual income refers to a person's income for the year prior to self-employment. It has been shown that the probability of survival is a function of the entrepreneur's assets (Evans and Jovanovic, 1989; Holz-Eakin et al., 1994; Cressy, 1996a). A person with greater assets can more easily survive harder times in business, especially when faced with liquidity constraints. On the other hand, earnings can be interpreted as the opportunity costs of self-employment (Holz-Eakin et al. 1994). A higher income before entering entrepreneurship may make the individual more willing to abandon self-employment, if the business is not profitable. Thus, the effect of prior income can be either positive or negative.

Many new businesses die young, and new organizations are found to have a higher risk of failure than older ones because of a scarcity of resources and a lack of legitimacy (Baum and Oliver, 1991). Thus, start-ups suffer from the "liability of newness" (cf. Stinchcombe, 1965). Here, duration dummies represent the age and "newness" of the business. The main feature of this kind of function is that it is constant in each interval, but may vary from one interval to the other. The first interval is used as the reference level. It is hypothesized that the older the business is, the greater its survival probabilities. This has been proved in many studies (see e.g. Taylor, 1999; Cowling, 2006). On the other hand, a nonlinear effect, where probabilities are first increased and then decreased after a certain maturity point, is also widely supported (see e.g. Bates, 1990, 1995; Pfeiffer and Reize, 1998; Cressy, 1996a).

The industrial sector indicates the structural characteristics and strategies of the new business. The industrial sector can be expected to capture differences in competitive position, scale economics and a number of other influences (Cowling, 2006). The industrial sector is included in the form of dummy variables. The chances of survival are expected to be smaller in more highly concentrated and more capital-intensive industries (Wagner, 1994). Cowling (2006) showed that firms in business services are associated with higher survival probability.

Pfeiffer and Reize (2000) found industrial sector to be a critical variable in the survival function. The lowest survival probabilities were found in the hospitality sector.

The regional attributes characterize the environment of the new firm. Region is characterized by the annual unemployment rate and region type (urban vs. rural). Unemployment can *a priori* either increase or decrease transitions into self-employment. A high unemployment rate indicates inadequate opportunities in the paid sector, which can be seen as a 'push factor' into self-employment (Moore et al. 2002). Similarly, a high local unemployment rate can induce self-employment for longer, since there are less other attractive options. At the same time, high unemployment may reduce the demand for the firm's products and services increasing the risk of bankruptcy and exit from self-employment (Parker, 2004).

The descriptive statistics of the variables chosen for this study are introduced in Table 1. Exact explanations for the variables can be found in Appendix 1. Some clear differences between the groups can be perceived in the key explanatory variables, which may be a sign of selection bias between the control and treatment groups. The importance of differences to variation in duration remains to be tested by propensity score matching. The self-employed persons who received start-up grants more often have education in the firm's field of operation. Fewer individuals have either only basic education or higher education. Shares of upper secondary or vocational education and a polytechnic or lower university degree are inversely higher than in the reference group. Non-supported entrepreneurs are more likely to have been employed at the end of the previous year, while almost half of the supported entrepreneurs were unemployed at that time. This makes sense, as at the time of granting, the applicants must be registered as job-seekers[2]. The number of serial entrepreneurs is higher among the non-supported group. The previous income of supported persons is lower than that of the others, and the unemployment level in their region is higher. These values are in accordance with the higher proportion of unemployed individuals.

Table 1. Descriptive statistics for spells with supported start-ups and non-supported start-ups in 1988-2001

Variable	**Supported start-ups (n=2 802)**	**Non-supported start-ups (n=18 165)**	**P-value**
Individual characteristics	Mean/share	Mean/share	
Human capital			
Age	36.8	37.8	0.000

Education			
Education in the firm's field of operation	48.8	33.8	0.000
Basic education	25.9	37.5	0.000
Upper secondary or vocational education	43.9	36.2	0.000
Polytechnic or lower university degree	26.3	19.6	0.000
Higher university degree	3.8	6.6	0.000
Education in business etc.	16.9	13.5	0.000
Education in technology etc.	32.3	25.7	0.000
Education in health care etc.	11.1	9.9	0.043
Education in service branch	10.5	9.8	0.211
Education in agriculture etc.	7.5	9.9	0.000
Prior experience			
Employed before self-employment	31.8	59.4	0.000
Unemployed before self-employment	44.7	13.4	0.000
Work experience in the same industry	24.1	11.7	0.000
Managerial experience	27.6	25.1	0.005
Earlier self-employment experience	32.3	45.7	0.000
Social capital			
Married	78.3	78.9	0.445
Spouse self-employed	5.8	9.2	0.000
Father self-employed	28.6	29.3	0.451
Mother self-employed	24.2	23.9	0.724
Father higher-educated	4.2	5.1	0.049
Mother higher-educated	2.6	3.6	0.007
Controls			
Female	42.1	38.1	0.000
Children	54.8	51.7	0.002
Organizational and environmental characteristics			
Income (10 000 €)	1.2	1.5	0.000
House-owner	68.4	72.8	0.000
Manufacturing sector	16.0	8.0	0.000
Construction sector	9.4	11.7	0.000
Trade sector	24.6	16.3	0.000
Hotels and restaurants sector	5.7	4.8	0.044
Transport sector	3.2	5.9	0.000
Real estate sector	12.4	7.5	0.000
Location in urban or sparsely populated area	71.8	75.0	0.000
Unemployment level in the region	16.1	11.8	0.000

Notes: P-values under the null hypothesis of equal shares for discrete variables are calculated by using Fisher's exact test and of equal means for continuous variables by using a two-sided t-test.

4 Econometric modelling of self-employment duration

Due to the interval censored data, discrete time specification for modelling the hazard rate is necessary. Discrete time survival data may arise for one of two reasons: either the time scale is intrinsically discrete or survival occurs over continuous time but spell lengths are observed only in intervals. Here, the underlying process is continuous, as the transition to and from self-employment may occur on a daily basis. Thus, an estimate of the parameters describing the continuous time hazard are derived, taking into account the nature of grouped time data. In this case, the discrete hazard rate $h(a_j)$, also known as the interval hazard rate, is the probability of exit in the interval $(a_{j-1}, a_j]$, and it is defined as:

$$h(a_j) = P(a_{j-1} < T \leq a_j \mid T < a_{j-1}) = 1 - \frac{S(a_j)}{S(a_{j-1})}, \quad (1)$$

where $S(a_{j-1})$ is the value of the survivor function at the start of the jth interval and analogously $S(a_j)$ is the value of the survivor function at the end of the same interval j. The probability of survival until the end of interval j, assuming that the hazard rate is constant over time, can be defined as

$$S(j) = \prod_{k=1}^{j}(1 - h_k) = (1 - h)^j . \quad (2)$$

In this case, survival times follow a geometric distribution, i.e. $h_j=h$ for all intervals j. The corresponding failure function is defined as follows

$$F(j) = 1 - S(j) = 1 - \prod_{k=1}^{j}(1 - h_k) = 1 - (1 - h)^j \quad (3)$$

The specification most commonly used in discrete-time hazard models is the logistic model, which was primarily developed for intrinsically discrete data, but has been shown to be consistent with underlying continuous data as well (Sueyoshi, 1995). Another widely used specification is the so-called complementary log-log (cloglog) model, which is the discrete time representation of a continuous time proportional hazards model. (Jenkins, 2005) The cloglog model is derived as

$$h(j, X) = 1 - \exp(-\exp(\beta' X + \gamma_j)), \quad (4)$$

where γ_j is the log of the difference between the integrated baseline hazard evaluated at the end and at the beginning of interval j. γ_j are assumed to summarize the pattern of duration dependence in the interval hazard and to be consistent with the different shapes of the hazard function within each spell.

The problem of unobserved heterogeneity (frailty) stems frequently from incomplete specification. The model with no frailty over-estimates the degree of negative duration dependence in the hazard. In addition, the proportionate response of the hazard rate to a change in a regressor is no longer constant and the true proportionate response of hazard to a change in a regressor is underestimated. (Bergström and Eden, 1992; Lancaster, 1979) The presence of unobserved heterogeneity is conceivable in the case of self-employment due to totally unobservable entrepreneurial skills, which are uncorrelated with observable skills (Falter, 2001). Fortunately, duration models can be extended to account for heterogeneity in a

number of ways. In this study, the existence of unobserved heterogeneity (frailty) is tested by estimating a cloglog model which incorporates a normally distributed random effects term with mean zero to summarize unobserved frailty connected to each spell. The random effects term describes unexplained heterogeneity, the influence of unobserved risk factors in the model. The assumption of a normal distribution is usually the most convenient in the case of discrete duration models for computational reasons.

The non-parametric baseline is chosen as the functional form for the basic hazard models, which means that the baseline hazard is allowed to vary freely with duration time *t* (duration dummies). Estimators of all models are obtained by the method of maximum likelihood. Due to censoring, the likelihood function is constructed in two parts: one for uncensored spells and another for censored spells (Singer & Willet, 1993). The log-likelihood function for the cloglog model can be written in sequential response form (Jenkins, 1997):

$$\log L = \sum_{i=1}^{n} \sum_{j=1}^{t_i} \left\{ y_{ij} \log h_j(X_{ij}) + (1 - y_{ij}) \log\left[1 - h_j(X_{ij})\right] \right\} \qquad (5)$$

When comparing the survival of supported and non-supported firms, bias linked to selection into the start-up grant programme must be addressed. This selection bias can be reduced by matching the treated (granted) group with the untreated (control) group of spells. In order to do this, the propensity score matching method is adopted here. Propensity scores are useful methods for matching treated and non-treated groups when the treatment is targeted at a population defined by a set of observable characteristics which can be included in the regression model (Cameron & Trivedi, 2005). This is the case with the start-up grants. According to the rules, the applicant must have the requisite entrepreneurial experience or training, sufficient prerequisites for the intended entrepreneurial activities, and be registered as unemployed job-seeker, and the firm to be supported may not distort competition in the local market. These can be approximated with the variables of earlier self-employment and labour experience, education, region and industry. Participation in the public measures is dependent on the preferences of both applicants and the grant-awarding authorities, who in turn are influenced by complex political objectives (Hämäläinen, 1999). Therefore, several control variables such as age, marital status children, education, regional unemployment rate, unemployment duration, region type, industry and income are also used in the matching process. This method matches groups on propensity scores – conditional probability of

receiving treatment given vector of variables x, so that the comparison units are those whose scores are sufficiently close to the treated unit.

$$p(x) = \Pr[D = 1 \mid X = x], \qquad (6)$$

where D is a binary indicator of a treatment variable. The propensity score is computed using probit regression. In addition, it is assumed that the support condition applies, which means that for every x there is a positive probability of non-participation. Thus, untreated matches are found for the treated observations for every x. Nearest-neighbour matching with replacement is implemented in order to result in a proper number of matches.

5 Results

5.1 Comparison of duration

Interestingly, the nominal average length of self-employment spells is exactly the same in both groups, namely 4.07 years. However, supported firms have survived statistically better both through the first year and to the end of the period. 79.4 (44.6) per cent of supported firms have survived the first year (up to the end of 2002), whereas the numbers of non-supported firms are 74.0 and 37.2 per cent respectively. In order to observe the survivor and hazard (i.e. failure) rates for each cohort, the life-table method for the grouped survival time data is utilized (See Table 2). The survival rates of the self-employment spells with supported start-ups are higher than those of the others for all intervals. This is supported by the log-rank test, which rejected the equality of survival functions at the 1 per cent significance level.

Table 2. Life-table estimates of self-employment survival and hazard rates

	Supported start-ups				**Non- supported start-ups**			
Interval (year)	Beginning total	Survival	Hazard	Cum. failure	Beginning total	Survival	Hazard	Cum. failure
1	2 852	0.794	0.206	0.206	18 165	0.740	0.260	0.260
2	2 120	0.666	0.162	0.334	12 562	0.604	0.184	0.396
3	1 660	0.576	0.134	0.424	9 485	0.514	0.149	0.486
4	1 298	0.515	0.107	0.485	7 432	0.454	0.117	0.546
5	1 031	0.466	0.095	0.534	5 996	0.407	0.101	0.593
6	811	0.426	0.085	0.574	4 872	0.370	0.091	0.630
7	652	0.393	0.078	0.607	3 987	0.341	0.080	0.659
8	469	0.363	0.077	0.637	3 241	0.314	0.079	0.686
9	292	0.341	0.058	0.659	2 590	0.296	0.057	0.704
10	160	0.331	0.031	0.669	1 970	0.279	0.058	0.721
11	102	0.318	0.039	0.682	1 539	0.261	0.063	0.739
12	73	0.309	0.027	0.691	1 120	0.249	0.048	0.751
13	58	0.283	0.086	0.718	669	0.235	0.057	0.765
14	24	0.259	0.083	0.741	281	0.226	0.036	0.774

No radical decline in the survival rates of supported spells is seen after a year, which is the maximum time for which a start-up grant can be awarded. Supported entrepreneurs seem to be for the most part real entrepreneurs and not in business only by courtesy of public funding. The shape of the survival function is similar in both groups, but the decrease after 12 years is slightly steeper in the supported start-up group (see Figure 1). The hazard rate of supported spells is respectively smaller for the first six intervals and for intervals 10 – 12. It is only at the end of the period that the hazard function of supported spells shows a sharper rise than that of non-supported spells.

Notably, the survival rates of all firms are rather low after the first years. The non-supported group has shrunk to less than half after three years. For the supported group, this boundary is broken a year later. Only one third of supported start-ups are running after the first ten years. However, this number is even lower for other firms. These numbers are even lower than in prior studies from other countries. For example, Scarpetta et al. (2002) discovered that up to 50 per cent of entering firms are still in business seven years later.

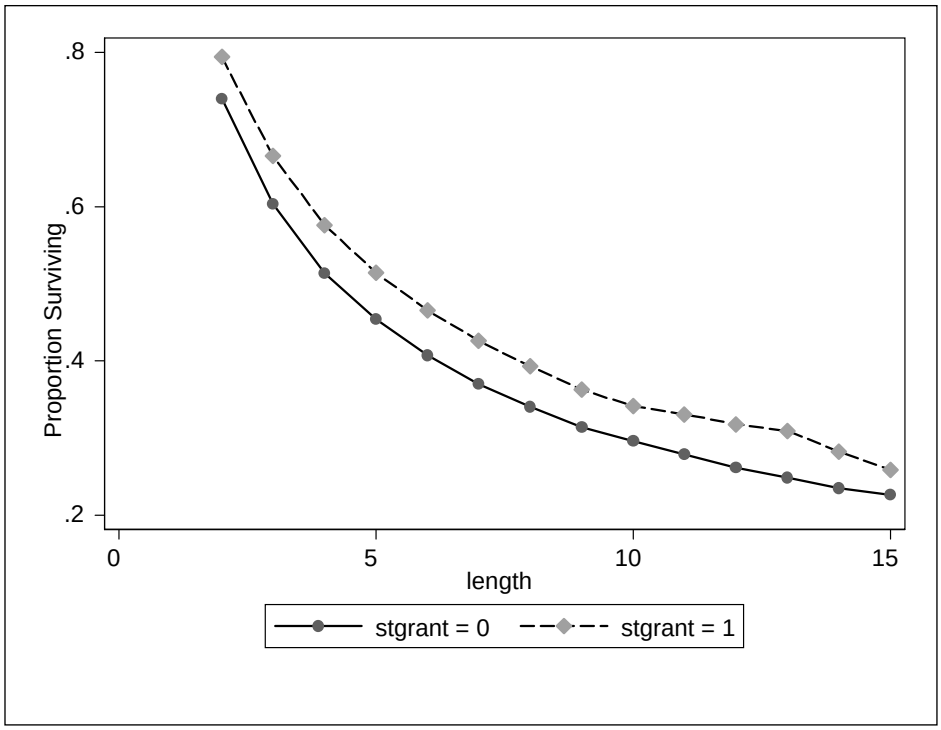

Figure 1. Survival functions for the supported spells (stgrant=1, n=18 165) and for the non-supported spells (stgrant=0, n=2 852)

5.2 Determinants of survival

In order to compare the determinants of survival between supported and non-supported start-ups, the matched data are used. The propensity score matching for the first spells of entrepreneurship yields 4 623 spells, of which 2 709 are treated and 1 914 control spells due to matching with replacement. The results of the probit regression are presented in Appendix 2. Most of the independent variables were found to cause selection bias in start-up grant treatment. However, the matching process significantly reduced the bias between the groups in the case of the majority of the variables. The reduction of bias indicates that groups are more similar in terms of the characteristic. In some variables, the difference between the treated and the control groups slightly increased but remained statistically non-significant.

Table 4 displays the results of the preferred model for the supported and non-supported start-ups. It is a cloglog –model with unobserved heterogeneity, which also refers to the frailty model. A logit-model, a cloglog-model without heterogeneity and a heterogeneity model with a Gamma distributed random term were also estimated, but the presented model was chosen according to the model selection criteria. The likelihood ratio test suggests that the frailty

term is statistically significant. The frailty model also has the lowest Akaike Information Criterion (AIC) value. Thus, the model incorporating a random effects term fits the data best. The results, however, seem to be very robust. The coefficients and their significances are very similar in all the models. The coefficients of the heterogeneity model are slightly larger in absolute value. This is to be expected, as excluding unobserved heterogeneity induces an under-estimate of the extent to which the hazard rate increases with duration and attenuates the magnitude of the impact of covariates on the hazard rate (Jenkins, 1997).

Next, the determinants of survival are considered (Table 3). The results of the hazard function give the probability of leaving self-employment at time *t* given that the self-employment spell has lasted up to that time. They thus give the rate of failure conditional on survival to that moment. A negative coefficient expresses a decrease in hazard rate and an increase in duration, while a positive coefficient shows larger hazard and weaker survival rates. The marginal effects and the exponentiated coefficients[4] obtained from the frailty models are shown in Appendix 3.

First of all, the results for supported and non-supported firms differ to a great extent. For non-supported start-ups, the majority of the explanatory variables prove to be significant and their behaviour is as assumed. For supported start-ups, the influence of explanatory variables is much less significant. In contrast, certain variables have strong and significant impacts on duration.

Table 3. Determinants of survival for supported and non-supported start-ups

	Supported start-ups		**Non-supported start-ups**	
	Coefficient	Std. Err.	Coefficient	Std. Err.
Individual characteristics				
Human capital				
Age	-0.074***	0.016	-0.045*	0.018
Age2	0.001***	0.000	0.001*	0.000
Education				
Education in the firm's field of operation	-0.301***	0.098	-0.421***	0.115
Basic education (reference)				
Upper secondary or vocational education	-0.254	0.250	-0.974**	0.307
Polytechnic or lower university degree	-0.275	0.258	-0.805*	0.312
Higher university degree	-0.354	0.304	-1.248	0.347
Basic education (reference)				
Education in business etc.	0.534*	0.289	1.359***	0.345
Education in technology etc.	0.352	0.270	1.284***	0.332
Education in health care etc.	0.205	0.277	0.762*	0.344
Education in the service branch	0.245	0.290	0.882*	0.350
Education in agriculture etc.	0.170	0.174	0.422*	0.203

Experience				
Employed before self-employment	-0.107	0.102	0.097	0.108
Unemployed before self-employment	-0.160*	0.083	-0.420**	0.140
Work experience in the same industry	-0.557***	0.155	-0.460**	0.154
Managerial experience	-0.223*	0.088	-0.068	0.105
Earlier self-employment experience	0.085	0.086	0.216*	0.100
Social capital				
Married	-0.120*	0.089	-0.290**	0.110
Spouse self-employed	-0.109	0.144	-0.181	0.172
Father self-employed	-0.065	0.094	-0.089	0.111
Mother self-employed	-0.093	0.092	-0.509***	0.119
Father higher educated	-0.089	0.176	-0.051	0.225
Mother higher educated	0.120	0.212	0.530*	0.263
Controls				
Female	0.074	0.075	0.160*	0.096
Children	0.204**	0.080	0.149*	0.090
Organizational and environmental characteristics				
Income (10 000 €)	-0.102*	0.050	-0.159**	0.054
Home-owner	-0.536***	0.115	-0.406***	0.095
Other small industrial sectors (reference)				
Manufacturing sector	-0.023	0.106	-0.657***	0.143
Construction sector	-0.023	0.135	-0.835***	0.175
Trade sector	0.102	0.093	-0.482***	0.125
Hotels and restaurants sector	0.243	0.145	-0.250	0.176
Transport sector	-0.993**	0.295	-1.934***	0.312
Real estate sector	0.081	0.118	-0.612***	0.158
Location in an urban area	0.149*	0.080	-0.009	0.095
Unemployment level in the region	0.017*	0.009	0.001*	0.010
Year (reference 1989)				
1990	0.230	0.273	0.342	0.285
1991	0.743**	0.268	0.450	0.298
1992	0.580*	0.265	0.734*	0.289
1993	0.560*	0.257	0.593*	0.283
1994	0.242	0.274	0.302	0.316
1995	0.332	0.271	0.574	0.310
1996	0.129	0.273	0.373	0.313
1997	0.092	0.275	0.010	0.319
1998	-0.131	0.278	0.247	0.318
1999	0.060	0.255	-0.020	0.292
2000	0.112	0.255	0.223	0.292
2001	0.084	0.257	0.195	0.297
2002	-0.384	0.271	-0.668*	0.309
Duration (reference 1 year)				
2 years	-0.106	0.168	0.299*	0.126
3 years	-0.111	0.256	0.425*	0.179
4 years	-0.202	0.326	0.268	0.219
5 years	-0.191	0.384	0.371	0.250
6 years	-0.232	0.433	0.427	0.279
7 years	-0.281	0.478	0.007	0.322
8 years	-0.144	0.523	0.498	0.336
9 years	-0.301	0.584	0.108	0.422
10 years	-0.912	0.718	0.407	0.481
11 years	-0.702	0.767	1.171*	0.482
12 years	-1.056	0.925	0.105	0.800
13 years	0.340	0.770	0.737	0.811
14 years	0.598	0.986	1.484	1.097
Sigma_u[a]	0.773	0.386	1.319	0.167
Rho[b]	0.266	0.195	0.514	0.063
LR-test of Rho=0[c]	2.43*		20.57***	

AIC	8372.69	8775.91

Notes: * significant at 10 %; ** significant at 1 %; *** significant at 0.1 %. a) the standard deviation of the heterogeneity variance b) the ratio of the heterogeneity variance to one plus the heterogeneity variance c) if the hypothesis that rho is zero cannot be rejected, then frailty is unimportant.

General human capital, namely age, reduces the risk of failure for both groups at first, whereas later on its effect becomes positive. Middle-aged persons have higher survival rates than very young or old entrepreneurs. This is in line with the prior studies introduced in chapter 3.2. The influence is stronger and more significant for supported start-ups. As expected in the human capital theory (Becker, 1975; Brüderl et al, 1992), education in the firm's field of operation, i.e. industrial specific experience, has a notable positive effect on duration for both groups. The marginal effect for the hazard is -3.3 per cent in the group of supported start-ups, whereas the odds ratio for failure for such educated persons is only 74 per cent of that of others. For non-supported firms, these effects are -5.6 per cent and 65.6 per cent respectively. Additionally, level of education plays a greater role in the survival of non-supported start-ups. A high level of education significantly reduces the risk of failure for non-supported start-ups, but has a non-significant effect for supported firms. The same applies for the education fields. Only education in business, law or social sciences shows a negative correlation to survival probability in comparison to basic education. Unemployment before self-employment increases the duration of both groups, whereas paid-employment has no significant effect. Work experience in the same industry and managerial experience spells better chances of survival for the supported group. Work experience in the same industry has a similar effect for the non-supported group. Earlier self-employment experience indicates a higher risk of exiting self-employment for the non-supported group. Serial entrepreneurs may frequently go in and out of self-employment, which has the effect of increasing the hazard rate of all individuals with prior experience. It is possible that persons with only a few prior spells of self-employment benefit from experience, but this remains to be explained. For supported start-ups, the influence of self-employment experience was non-significant, although prior experience or training was expected in order to receive start-up grant.

The components of social capital are rather unimportant in the survival of supported start-ups. Only the variable of being married influences survival positively. The marginal effect of being married is -2.3 per cent for the hazard risk in comparison to non-married entrepreneurs. For non-supported start-ups, this effect is -4.1 per cent. In addition, the mother's characteristics have an impact on duration. If an entrepreneur's mother has been self-

employed, the odds for failure are only 60 per cent of that of others. Instead, if the mother is highly educated, the odds are 1.7 times those of entrepreneurs whose mothers are not highly educated. The explanation for this is ambiguous.

Gender is non-significant for the duration of the supported start-ups, even though female entrepreneurs have traditionally been found to suffer from lower survival rates (cf. Bates, 1998; Bosma et al., 2004; Lin et al., 2000; Pfeiffer and Reize, 2000). However, in the case of the non-supported firms, men do have a higher propensity to remain in self-employment. Having children is more likely to lead to exiting self-employment in both groups.

Of the organizational and environmental characteristics of firms, assets have a significant positive impact on the survival of both groups, as expected. Sector is a more important factor for survival in the non-supported group than in the supported group, whereas regional characteristics are more important for supported start-ups. Higher earnings before entering self-employment and home-ownership both have a positive effect on survival. Non-supported firms in most of the largest industries - i.e. manufacturing, construction, trade, real estate and especially transport - have a smaller relative hazard risk than those in smaller industries. Thus, starting a business in a smaller and less common business domain has worse survival chances. In the group of supported firms, on the other hand, a significant decrease in hazard is only found in the transport sector. Again with regards to the industrial sector, non-supported firms behave more in accordance with the theory and the prior studies (cf. Cowling, 2006; Pfeiffer and Reize, 2000). Location in an urban area and a higher level of unemployment in the region indicate a higher risk of failure for supported firms, but no strong conclusions can be drawn from these regional results.

Next, the influence of the start-up grant on survival can be estimated by duration modelling with the start-up grant as an explanatory variable (Table 4). Different specifications are estimated in order to check the robustness of the impact. For brevity the rest of the coefficients are not presented again (cf. Table 3). Firstly, we can see that receiving a public start-up grant for entering self-employment has a negative coefficient. Hence, the duration of the supported start-ups is longer than that of the others. The marginal effect, conditional on receiving start-up support, is between -3.6 and -4.0 %. This is contrary to Pfeiffer and Reize (2000), who found that the survival of subsidized firms was lower in the regions of Germany.

The result here shows a positive dependence between start-up grants and self-employment duration, despite the fact that supported entrepreneurs initially have poorer prospects in the sense they are not able to start their businesses without public support. Although the grants are allotted to secure the self-employed person's livelihood only during the first months, or at most a year, their impact on the firm's operation seems to be more prolonged. It is possible that the "gap" between supported and non-supported groups did not exist after all. Probably individuals in the supported group were better prepared for entrepreneurship than the others, who did not undergo careful selection and special training.

Table 4. Estimated coefficients and marginal effects for start-up grant effect from the frailty cloglog-model

	Specification 1 All		**Specification 2 Individual**		**Specification 3 Organizational and environmental**		**Specification 4 Human capital**	
Variable	**Coeff. Std. Err.**	**Marg. effect**	**Coeff. Std. Err.**	**Marg. effect**	**Coeff. Std. Err.**	**Marg. effect**	**Coeff. Std. Err.**	**Marg. effect**
Start-up grant	-0.313 ***	-0.038 ***	-0.293 ***	-0.037 ***	-0.285 ***	-0.036 ***	-0.310 ***	-0.040 ***
	0.058		0.059		0.058		0.058	
Individual characteristics								
General human capital	YES		YES		YES		YES	
Education	YES		YES		NO		YES	
Experience	YES		YES		NO		YES	
Social capital	YES		YES		NO		NO	
Controls	YES		YES		NO		YES	
Organizational and environmental characteristics	YES		NO		YES		NO	
Duration dummies	YES		YES		YES		YES	
Cohorts	YES		YES		YES		YES	
LR-test of Rho=0	22.25***		14.77***		22.00***		19.28***	

Notes: * significant at 5%; ** significant at 1 %; *** significant at 0.1 %.

5.3 Exit from self-employment

Until now, only general failure, i.e. the discontinuity of the firms, has been analyzed. In this final section, the reasons for discontinuity are considered. The reasons for exiting are derived from the status of employment after the self-employment period. If a person ends up unemployed, there is a strong probability that the self-employment has ended involuntarily,

i.e. due to the failure of the firm. An entry into paid-employment usually indicates a voluntary exit from self-employment, as it is a sign of a better employed labour market match (Taylor, 1999). An entrepreneur may even become an employee in his or her own firm, if the firm is bought by another individual or firm. Here, three consequences of exiting self-employment are recognized. They include unemployment, paid-employment and out of the labour force (economically inactive), which includes retirement, maternity leave, military service, studying and some other activities (cf. Georgellis et al., 2007). Transfer out of the labour force may happen either voluntarily or involuntarily.

First, the reasons for exiting are compared between supported and non-supported firms. Overall, the exit rate of non-supported firms is significantly higher than the exit rate of supported ones (Table 5). The main reason for exiting self-employment is paid-employment for both groups. Almost half of the supported entrepreneurs exited self-employment due to paid-employment opportunities. Less than one third exited due to evident failure. However, supported entrepreneurs became unemployed more often than non-supported entrepreneurs, who ceased business for other reasons.

Table 5. Reasons for exiting according to post-self-employment activity

	Supported firms	**Non-supported firms**	**P-value**
Paid-employment	44.8	45.5	0.627
Unemployment	31.6	21.4	0.000
Out-of-the labour force	23.7	33.1	0.000
Overall exit rate	**55.4**	**62.8**	**0.000**

Table 6 shows the results (marginal effects) of the competing risk models for supported start-ups. A cloglog-model with heterogeneity is preferred for modelling exit to paid-employment and a cloglog-model without heterogeneity for other estimations. Age has a similar effect on all the reasons for exiting. Education in the firm's field of operation decreases the probability of transfer into unemployment and other activities. Higher degrees of education negatively affect transfer into paid-employment. Individuals with education in the field of health care, teaching, humanities, agriculture or forestry are more likely to exit due to paid-employment and less likely due to unemployment. Employment before self-employment increases the likelihood of paid-employment after the self-employment period. The opposite is true considering exit into other activities. Having been unemployed before becoming self-employed slightly increases the probability of returning to unemployment. Taylor (1999)

reports similar findings for employment experience. Interestingly, work experience in the same industry and managerial experience decrease the probability of both paid-employment and unemployment after exit. Social capital is only significant in the case of exit into unemployment. Rates of exit into unemployment are reduced for persons who are married and whose father is self-employed or higher educated. Female entrepreneurs are more likely to exit into other activities, which is understandable, as the 'other activities' class includes maternity leave. In Cueto and Mato (2006), women were also found to have a higher exit rate for reasons other than entry into paid-employment. Persons with children exit with higher rates into paid-employment and into unemployment. Probably sufficient livelihood is more important for this group. Assets significantly affect all types of exit. Home-ownership decreases all types of exit. Higher income slightly increases exit into paid-employment, but reduces other types of exits. Georgellis et al. (2007) suggests that individuals rather stay in self-employment as their wealth increases. Business in the transport sector diminishes the number of all exit types. Business in the hotel and restaurant sector shows an increased rate of exit into paid-employment and self-employment. Regional characteristics have only minor effects on exit rates.

Table 6. Competing risk models of self-employment duration of supported start-ups

Variable	Paid-employment	Unemployment	Other activities
Individual characteristics			
Human capital			
Age	-0.003***	-0.003***	-0.004***
Age2	0.001**	0.001***	0.001***
Education			
Education in the firm's field of operation	-0.004	-0.010**	-0.008***
Upper secondary or vocational education	-0.024*	0.014	-0.003
Polytechnic or lower university degree	-0.013	0.008	-0.011
Higher university degree	-0.017*	0.010	-0.008
Education in business, law or social sciences	0.035*	-0.005	0.014
Education in technology, natural sciences or computer science	0.026*	-0.009	0.008
Education in health care, teaching or humanities	0.031*	-0.015*	0.005
Education in the service branch	0.024	-0.013*	0.004
Education in agriculture and forestry or unspecified field	0.020*	-0.010*	-0.005
Experience			
Employed before self-employment	0.007*	-0.004	-0.010*
Unemployed before self-employment	-0.003	0.001*	-0.008*
Work experience in the same industry	-0.014**	-0.011**	-0.004
Managerial experience	-0.006*	-0.005*	0.001
Earlier self-employment experience	0.001	0.003	0.004
Social capital			
Married	0.001	-0.016***	-0.002
Spouse self-employed	-0.008	0.005	0.003

Father self-employed	0.001	-0.008**	0.002
Mother self-employed	-0.004	-0.004	-0.001
Father higher educated	0.001	-0.018***	0.007
Mother higher educated	0.001	0.002	0.002
Controls			
Female	-0.004	0.001	0.010**
Children	0.010***	0.010***	-0.003
Organizational and environmental characteristics			
Income (10 000 €)	0.003*	-0.009***	-0.007*
Home-owner	-0.014***	-0.016***	-0.008*
Other small industrial sectors (reference)			
Manufacturing	0.004	0.001	-0.006*
Construction	0.003	0.004	-0.006
Trade	0.004	0.006	-0.003
Hotels and restaurants	0.014*	0.012*	-0.007
Transport	-0.014*	-0.019***	-0.016***
Real estate	0.012*	-0.008*	-0.002
Location in an urban area	0.005*	0.002	-0.001
Unemployment level in the region	-0.001	0.001*	0.001

Notes: Models include duration and year dummies.

6 Conclusions

The expectations of growth and employment associated with new self-employment may only be fulfilled if sufficient number of start-ups survives. The survival of supported start-ups is a matter of social interest, as public resources are wasted if the new supported entrepreneur quits shortly after entering self-employment. By combining different empirical aspects, this paper focused on the survival of supported start-ups.

Evidently, the survival of supported and non-supported firms arises from different factors. On the whole, the survival of non-supported firms was better explained by human capital, social capital and organizational ecology, as suggested in the approach by Brüderl et al. (1992). However, the survival of supported start-ups was strongly connected to certain characteristics such as industry-related education, industry-related work experience, managerial experience and assets. These characteristics seem to be crucial for the survival and success of supported entrepreneurs. In the process of deciding who should receive start-up grants, applicants with these characteristics could be at an advantage, assuming that the need for public financial support can be demonstrated.

An important finding of this study is that start-up grants have a positive impact on self-employment duration even after controlling for selection bias related to start-up grant

selection and unobserved entrepreneurial skills. Contrary to the findings of some previous studies, the risk of failure was found to be clearly smaller for supported spells of self-employment for all duration specifications. One reason for the better survival of supported firms lies in the prerequisites for awarding a grant. Start-up grant recipients must have either prior self-employment experience or appropriate training for self-employment. Their entrepreneurial capabilities, along with their business plans, are extensively evaluated by experts in start-up activities. It is obvious that the chances of survival for firms that have undergone such an assessment process are improved in comparison to firms whose business concepts have not necessarily been scrutinized as closely (see e.g. Chrisman et al., 2005).

Mere discontinuity of business does not necessarily entail that a firm ended due to failure. The reasons for exiting provide more interesting information on whether the exit took place voluntarily or involuntarily, due to failure or non-failure. Both non-supported and supported entrepreneurs mostly ended up in paid-employment, which is regarded as a voluntary action. However, the difference between the two groups can be seen in other exit alternatives. Supported entrepreneurs became unemployed more often, whereas non-supported entrepreneurs more frequently ended up out of the labour force after exiting self-employment. More information is needed in order to evaluate the superiority of these alternatives.

In all, the potential entrepreneur should be aware that a successful business can be started with the help of a public grant. Even upon exiting entrepreneurship, the result is mostly positive (i.e. the person finds a better paid-employment opportunity). From a social viewpoint, the results provide useful information both on the effectiveness of start-up grants and on the identification of the most promising entrepreneurs in terms of survival, which in turn may be used in formulating more effective policies to promote new durable self-employment. Start-up subsidization proved to be an efficient self-employment measure for the registered job-seekers in this study. This supports extending the start-up grant scheme to other potential target groups. The cost of start-up grants is relatively small if the outcome is durable employment and/or successful business.

Notes:

[1] This measure is known by different names in different countries: for example, self-employment assistance, bridging allowances or support grant for self-employment (OECD, 2000).

[2] However, transition from these labour market positions to that of registered job-seeker as a condition for a grant was possible, as no minimum spell of unemployment was laid down. The target group has since been experimentally expanded to persons moving from paid employment, studies or home-making to full-time entrepreneurship.

[3] Stata program xtcloglog is used for the estimation of the Normal distributed frailty model.

[4] The marginal effects are calculated as the change in a given outcome's probability according to a unit change in the covariate. In the case of dummy variables, the change is from a value of 0 to a value of 1. Exponentiated coefficients can be interpreted as hazard ratios (i.e. odds ratios), which represent the effect of a unit change in the value of Xj on the hazard rate. In other words, they are the relative odds of survival to a given point in time t for two observations which differ by a value of 1 on some covariate.

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Appendix 1 Definitions of variables

Variable	Definition	Measurement time
Start-up grant	1 if received start-up, 0 otherwise (oth.)	Start-up year/following year to start-up year
Individual characteristics		
Human capital		
Age	Age in years	Start-up year
Education		
Education in the firm's field of operation; formed by matching the education field with the firm's industry, according to the skills publicized as being taught within the education field.	1 if education is in the firm's field of operation, 0 oth.	The firm's field of operation in the start-up year compared to the education field in the start-up year and earlier years 1970, 1975, 1980, 1985, 1987-2002
Upper secondary or vocational education	1 if upper secondary or vocational education, 0 oth.	Start-up year
Polytechnic or lower university degree	1 if polytechnic or lower university degree, 0 oth.	Start-up year
Higher university degree	1 if higher university degree, 0 oth.	Start-up year
Education in business, law or social sciences	1 if education in business, law or social sciences, 0 oth.	Start-up year
Education in technology, natural sciences or computer science	1 if education in technology, natural sciences or computer science, 0 oth.	Start-up year
Education in health care, teaching or humanities	1 if education in health care, teaching, or humanities, 0 oth.	Start-up year
Education in the service branch	1 if education in service branch, 0 oth.	Start-up year
Education in agriculture and forestry or unspecified field	1 if education in agriculture and forestry or unspecified field, 0 oth.	Start-up year
Prior experience		
Employed before self-employment	1 if employed, 0 oth.	End of previous year to start-up
Unemployed before self-employment	1 if unemployed before self-employment, 0 oth.	End of previous year to start-up
Work experience in the same industry	1 if work experience in the same industry before self-employment spell, 0 oth.	Years prior to start-up 1970, 1975, 1980, 1985, 1987-2002
Managerial experience	1 if managerial experience before self-employment, 0 oth.	Years prior to start-up 1970, 1975, 1980, 1985, 1987-2002
Earlier self-employment experience	1 if earlier self-employment spells, 0 oth.	Years prior to start-up 1970, 1975, 1980, 1985, 1987-2002
Social capital		
Married	1 if married or cohabiting, 0 oth.	Start-up year
Spouse self-employed	1, if spouse has been self-employed, 0 oth.	Start-up year and earlier years 1970, 1975, 1980, 1985, 1987-2001
Father self-employed	1, if father has been self-employed, 0 oth.	Start-up year and earlier years 1970, 1975, 1980, 1985, 1987-2001
Mother self-employed	1, if mother has been self-employed, 0 oth.	Start-up year and earlier years 1970, 1975, 1980, 1985, 1987-2001
Father higher-educated	1, if father has higher university degree, 0 oth.	Start-up year and earlier years 1970, 1975, 1980, 1985, 1987-2001
Mother higher-educated	1, if mother has higher university degree, 0 oth.	Start-up year and earlier years 1970, 1975, 1980, 1985, 1987-2001
Control variables		
Female	1 if female, 0 if male	Start-up year
Children	1 children under 18 years are living at home, 0 oth.	Start-up year
Organizational and environmental characteristics		

Income (10 000 €)	Annual income	Previous year to start-up
House-owner	1 if house or apartment owner, 0 oth.	Start-up year
Manufacturing sector	1 if the industrial sector is manufacturing, 0 oth.	Start-up year
Construction sector	1 if the industrial sector is construction, 0 oth.	Start-up year
Trade sector	1 if the industrial sector is trade, 0 oth.	Start-up year
Hotels and restaurant sector	1 if the industrial sector is hotel or restaurant, 0 oth.	Start-up year
Transport sector	1 if the industrial sector is transport, 0 oth.	Start-up year
Real estate sector	1 if the industrial sector is real estate business, 0 oth.	Start-up year
Location in an urban or sparsely populated area	1 if the location of the firm is in an urban or sparsely populated area, 0 if the location of the firm is in a rural area	Start-up year
Unemployment level in the region	Annual unemployment rate in the region of the working place	Time-varying
Dummies of regions of location		
Region 1	1 if region of residence (r.o.r.) is Uusimaa, 0 oth.	Start-up year
Region 2	1 if r.o.r. is Varsinais-Suomi, 0 oth.	Start-up year
Region 4	1 if r.o.r. is Satakunta, 0 oth.	Start-up year
Region 5	1 if r.o.r. is Kanta-Häme, 0 oth.	Start-up year
Region 6	1 if r.o.r. is Pirkanmaa, 0 oth.	Start-up year
Region 7	1 if r.o.r. is Päijät-Häme, 0 oth.	Start-up year
Region 8	1 if r.o.r. is Kymenlaakso, 0 oth.	Start-up year
Region 9	1 if r.o.r. is Etelä-Karjala, 0 oth.	Start-up year
Region 10	1 if r.o.r. is Etelä-Savo, 0 oth.	Start-up year
Region 11	1 if r.o.r. is Pohjois-Savo, 0 oth.	Start-up year
Region 12	1 if r.o.r. is Pohjois-Karjala, 0 oth.	Start-up year
Region 13	1 if r.o.r. is Keski-Suomi, 0 oth.	Start-up year
Region 14	1 if r.o.r. is Etelä-Pohjanmaa, 0 oth.	Start-up year
Region 15	1 if r.o.r. is Pohjanmaa, 0 oth.	Start-up year
Region 16	1 if r.o.r. is Keski- Pohjanmaa, 0 oth.	Start-up year
Region 17	1 if r.o.r. is Pohjois- Pohjanmaa, 0 oth.	Start-up year
Region 18	1 if r.o.r. is Kainuu, 0 oth.	Start-up year
Region 19	1 if r.o.r. is Lappi, 0 oth.	Start-up year
Region 20	1 if r.o.r. is Itä-Uusimaa, 0 oth.	Start-up year

Appendix 2. Results of propensity score matching, probit regression

Variable	Coefficient	Std. Err.	% reduct bias
_cons	-3.880***	0.186	
Individual characteristics			
Human capital			
Age	0.093***	0.020	65.2
Age2	-0.001***	0.000	75.1
Education			
Education in the firm's field of operation	0.170***	0.034	94.8
Upper secondary or vocational education	0.128**	0.038	78.4
Polytechnic or lower university degree	0.263***	0.043	90.3
Higher university degree	0.083	0.071	94.8
Prior experience			
Employed before self-employment	-0.243***	0.039	98.7
Unemployed before self-employment	0.665***	0.036	95.0
Work experience in the same industry	-0.215***	0.040	93.8
Managerial experience	0.074*	0.032	97.6
Earlier self-employment experience	-0.271***	0.029	65.4
Social capital			
Spouse self-employed	-0.448***	0.053	82.2
Controls			
Female	0.114***	0.029	18.4
Organizational and environmental characteristics			
Income (10 000 €)	-0.084***	0.014	96.0
Home-owner	-0.017	0.030	94.8
Manufacturing	0.654***	0.045	95.1
Construction	0.118*	0.050	100.0
Trade	0.457***	0.038	85.0
Hotels and restaurants	0.194**	0.060	-30.2
Transport	-0.021	0.070	87.4
Real estate	0.446***	0.049	97.1
Location in an urban area	-0.040	0.032	88.1
Unemployment level in the region	0.009	0.007	97.4
Dummies of regions of location			
Region 2	0.213***	0.060	63.5
Region 4	0.701***	0.077	87.8
Region 5	0.215*	0.092	71.9
Region 6	0.441***	0.063	51.6
Region 7	0.575***	0.080	74.2
Region 8	0.621***	0.085	40.8
Region 9	0.564***	0.094	77.7
Region 10	0.492***	0.092	66.7
Region 11	0.492***	0.083	48.7
Region 12	0.609***	0.100	57.9
Region 13	0.658***	0.080	68.4
Region 14	0.620***	0.076	80.5
Region 15	0.315***	0.086	-10.7
Region 16	0.461***	0.118	-464.0
Region 17	0.463***	0.073	-229.9
Region 18	0.708***	0.126	85.8
Region 19	0.729***	0.107	64.6
Region 20	0.378***	0.097	-245.2
Cohorts			
Year 1989	0.051	0.071	89.3
Year 1990	-0.361***	0.086	97.8
Year 1991	0.346***	0.074	86.2
Year 1992	0.424***	0.073	-13.4
Year 1993	0.610***	0.123	89.4

Year 1994	0.721***	0.124	81.7
Year 1995	0.514***	0.125	79.3
Year 1996	0.461***	0.128	89.2
Year 1997	0.538***	0.127	65.8
Year 1998	0.687***	0.089	93.7
Year 1999	0.732***	0.090	87.9
Year 2000	0.544***	0.093	-282.7
Year 2001	0.713***	0.093	83.5

Notes: * significant at 5%; ** significant at 1 %; *** significant at 0.1 %.

Appendix 3. Marginal effects and exponentiated coefficients from the frailty models

	Supported start-ups		**Non-supported start-ups**	
Variable	Marginal effect	Exponentiated coeff.	Marginal effect	Exponentiated coeff.
Individual characteristics				
Human capital				
Age	-0.008***	0.928***	-0.006*	0.956*
Age2	0.001***	1.000***	0.001*	1.000*
Education				
Education in the firm's field of operation	-0.033**	0.740**	-0.056***	0.656***
Upper secondary or vocational education	-0.027	0.776	-0.122**	0.378**
Polytechnic or lower university degree	-0.028	0.760	-0.091**	0.447*
Higher university degree	-0.034	0.899	-0.103***	0.287**
Education in business, law or social sciences	0.069*	1.706*	0.259**	3.890***
Education in technology, natural sciences or computer science	0.040	1.423	0.207**	3.613***
Education in health care teaching or humanities	0.024	1.228	0.131*	2.3143*
Education in the service branch	0.029	1.278	0.155*	2.415*
Education in agriculture and forestry or unspecified field	0.020	1.186	0.064*	1.525*
Experience				
Employed before self-employment	-0.017	0.899	-0.053**	0.657**
Unemployed before self-employment	-0.011*	0.852*	0.013	1.101
Work experience in the same industry	-0.051***	0.573***	-0.053**	0.631**
Managerial experience	-0.023**	0.800*	-0.009	0.935
Earlier self-employment experience	0.009	1.089	0.029*	1.241*
Social capital				
Married	-0.023*	0.819*	-0.041*	0.748**
Spouse self-employed	-0.011	0.897	-0.022	0.834
Father self-employed	-0.007	0.937	-0.011	0.915
Mother self-employed	-0.010	0.911	-0.060**	0.601***
Father higher educated	-0.009	0.915	-0.006	0.950
Mother higher educated	0.013	1.116	0.086*	1.700*
Controls				
Female	0.008	1.077	0.021	1.173*
Children	0.022***	1.227*	0.019*	1.160*
Organizational and environmental characteristics				
Income (10 000 €)	-0.011*	0.903*	-0.021**	0.853**
Home-owner	-0.066***	0.585***	-0.058***	0.666***
Other small industrial sectors (reference)				
Manufacturing	-0.003	0.977	-0.073***	0.519***
Construction	-0.025	0.977	-0.084***	0.434**
Trade	0.011	1.108	-0.057***	0.618***
Hotels and restaurants	0.029	1.275*	-0.030	0.779
Transport	-0.074***	0.371***	-0.129***	0.144***
Real estate	0.009	1.085	-0.066***	0.542***
Location in an urban area	0.016*	1.161*	-0.001	0.991
Unemployment level in the region	0.018*	1.017*	0.001	1.001

Notes: * significant at 10%; ** significant at 1 %; *** significant at 0.1 %.