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Abstract

This paper addresses the issue of internal determination of organizational outcomes. It is argued that in small and simply structured organizations a considerable proportion of the variance in organizational activities and outcomes is associated with individuals. In particular, the paper uses human capital theory to derive hypotheses about individual determinants of organizational mortality. These hypotheses are tested with event-history data of firm registrations and de-registrations in a West German region. The hypotheses are corroborated by the data, but the effects may nonetheless be due to processes linking individual characteristics with organizational performance other than those suggested by the human capital approach.

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Introduction

This article investigates individual determinants of the viability of small firms. Until recently, the study of small organizations has been one of the neglected topics within the field of organizational research. However, on theoretical as well as practical grounds, this preoccupation with large and stable organizations seems problematic.

In the light of *transaction cost analysis*, for example, small organizations are an important subject of research (cf. for a recent discussion e.g. Lazerson 1988; Picot et al. 1989). Transaction cost theory focuses on the size distribution of firms which results from processes of vertical integration and disintegration or from subcontracting and related forms of the organization of work (Williamson 1975). In terms of transaction cost analysis 'viability' primarily means 'efficiency'. In contrast to this, we will analyse determinants of viability not in terms of properties of exchange relations, but in terms of individual capabilities and experiences. Furthermore, in accordance with the *ecological perspective* (Aldrich 1978; Carroll 1984; Hannan and Freeman 1989) we do not attempt to study the relative efficiency of various organizational forms directly, but consider *organizational mortality* as a proxy. The central issue of the ecological approach which explicitly addresses small organizations is to explain the diversity and distribution of organizational forms. In this regard it should be noticed that 'small is bountiful' (Granovetter 1984). It is generally known that in most Western nations the overwhelming majority of firms

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are small, and most working people are employed by small firms (or are self-employed). Furthermore, it seems that the trend towards larger firms has come to an end in several industrial societies. In the Federal Republic of Germany, for example, since 1978 one observes a stable number of self-employed people and a stable proportion of self-employed within the total number of working people (cf. *inter alia* Bögenhold 1987).

It is not only important to undertake research on small organizations for theory's sake. Current debates in the field of labour market politics are centred, to a large extent, around the topic of *job creation processes* based on establishing small firms. A starting point for these debates has been Birch's (1987) study of job creation within the U.S. economy. Birch tries to demonstrate the positive effects of foundation and expansion processes of small firms on the growth of the economy. However, Birch (1987: 52) concedes that there may be disadvantages resulting from those growth processes: '*the aggregate, macro stability of an economy flows from its micro instability, the instability of the individual firm*. The learning process associated with company instability is crucial to long-term adaptivity and job creation.' It is our contention that it is extremely important to explore in more detail the social costs of so-called 'flexibility' within the small firm sector.

Reasoning along these lines, it is tempting to conjecture that organizational research may contribute to the advancement of *social mobility and stratification* research. In the light of social mobility research it is necessary to answer the following research question: What are the consequences of various previous career paths and individual characteristics with respect to organizational mortality or other indicators of organizational and individual success (e.g. personal income)?

The purpose of this paper may now be expressed either by emphasizing the organizational aspect or the labour market and mobility aspect. First, we try to investigate the determinants of organizational mortality among small firms. Second, we will investigate the consequences of previous careers and individual characteristics of small business owners on organizational success.

The problem is first explored theoretically. This part contains arguments about the organizational structure of small firms. Furthermore, the core problem of linking individual characteristics and organizational outcomes is addressed by making use of human capital theory. This reasoning results in testable hypotheses about organizational mortality rates. In the second part of the paper, we test these hypotheses empirically. The data base is business registrations and de-registrations in the area of Munich and Upper Bavaria (West Germany) within the time period 1980–1984.

Theory

Individual Determinants of Organizational Activities and Outcomes

Within organizational research there is considerable scepticism with regard

to the relevance of individual or personal determinants of organizational activities. The attribution of organizational outcomes (e.g. success or failure) to certain personal dispositions of leaders, managers, entrepreneurs or other 'great men' in fact seems to correspond to a naive layman perspective. There are three main objections to the 'great men' approach (cf. e.g. Pfeffer 1977).

First it can be argued that organizational leaders are relatively homogenous with regard to personal characteristics such as education, social background, professional and personal skills, i.e. a sample of business leaders will probably not display a large variance in these variables. This is because processes of self-selection and recruitment into these kinds of careers entail the selection of certain similar personal characteristics. For example, Kanter (1977) describes managerial career patterns as characterized by 'homosocial reproduction'. As a consequence of this, one might suspect that individual variables will not explain considerable amounts of variation in the dependent organizational variables.

Second, organizations are often conceived as political entities. From this perspective, activities and outcomes are determined by the dynamics of internal coalitions. Leaders do not have complete freedom with regard to organizational activities, they are constrained to courses of action which are largely determined by other powerful actors within the organization.

Third, external and ecological approaches emphasize the role of environmental factors. To a large extent, organizational outcomes and performance depend on factors which are out of the control of the organization and their internal coalitions. Among these factors, for example, are business cycles, fluctuations in demand for certain products, institutional arrangements which may affect labour costs, location factors, and random events.

We do not want to question the validity of these arguments in general. Instead, we maintain that these arguments primarily apply to large and medium sized organizations. They are less relevant to young and small business firms which make up the largest fraction of business organizations.

We argue that these small organizations are 'simple' in Mintzberg's (1979: 305–313) sense. Structurally, they are rather simple, there is at most a loose division of labour, a small managerial hierarchy, and hardly any formalization of behaviour. Furthermore, power is centralized in the hands of the 'chief executive' or the owner himself (Mintzberg 1979: 306). In political respects, these simple organizations correspond to the personalized internal coalition type (Mintzberg 1983: 235–236), i.e. organizational activities largely depend on the personal tastes of a single individual who is able to control other agents within the firm by direct supervision. Therefore, one should expect leading individuals within these organizations to be in a position to use their own discretion to a large extent. There is some evidence that, in small firms, the personality of the chief executive

is, in fact, an important determinant of corporate strategy and structure (Miller and Dröge 1986; Miller and Toulouse 1986). In contrast to a body of literature, however, which primarily investigates psychological variables, such as the need for achievement (cf. e.g. Klandt 1984), we consider CEO's career histories and labour market experiences as important determinants of corporate strategy and success. Another aspect which should be noticed is the fact that within the set of the smallest firms one observes a significant variation of personal characteristics, career histories, and background variables. For example, in West Germany, many business start-ups seem to result from an attempt of would-be entrepreneurs to cope with an experience of unemployment (cf. Bögenhold 1985: 250; Weitzel 1986). The firms investigated below also show considerable variation with respect to the labour market experiences of their founders. Thus, it may be true that top managers of large corporations tend to be 'homosocial'; there are good reasons, however, to believe that this may not be true of small entrepreneurs (further evidence can be found, for example, in Szyperski et al. 1979; Borjas 1986; Fuchs 1982; Carroll and Mosakowski 1987). In particular, we are convinced that there is variation in the human capital variables of small business entrepreneurs. In accordance with external and ecological approaches we concede that environmental variables are extremely important determinants of organizational performance. This especially seems to be the case for the smallest organizations, because they obviously are less able to control or manipulate their environment. However, we conjecture that individuals also make a difference.

Entrepreneur Human Capital, Organizational Performance and Organizational Mortality

The previous section has established the general argument that it seems worthwhile to look at individual determinants of organizational activities. In the following, we want to continue that line of reasoning and attempt to answer the question of whether there are specific individual variables which may explain, at least partially, organizational outcomes. In order to accomplish that task we make use of *human capital theory* (cf. Becker 1975 as a classic source).

Human capital theory shares the assumption of rational behaviour with other microeconomic approaches. Within the field of labour economics, it can be considered as one of the most elaborated theories. It also enables insights into a variety of empirical phenomena (cf. Willis 1986 for a survey). In general, the human capital approach is employed in two fairly distinct ways: first, and this may be taken as the more common application, human capital theory may predict an agent's optimal amount of investments in human capital over the life cycle. The most important determinant of those investments are the (expected rates of) returns on human capital. Second, in empirical analyses, human capital theory is used to explain earnings and earnings distributions. This more indirect application is especially fruitful within social stratification and inequality

research (cf. Mincer 1974). It is this second approach, in particular, which we want to use.

Though there is a large set of potential applications of human capital theory, very few authors have tried to use the theory in analyses of entrepreneurial human capital and the profitability of small firms. Among these few studies we mention a work by Bates (1985) who focuses on the effects of human capital endowments on minority business viability. Bates's theoretical argument is not very explicit. Basically, he maintains that there is a positive relationship between entrepreneurial human capital and firm profitability. Furthermore, Bates holds that there are other factors fostering profitability, namely the amount of material resources invested in the organization (as measured by financial capital inputs).

Bates's approach reveals some weaknesses in the data and the empirical test. First, Bates uses, as does Birch (1987), Dun and Bradstreet (D&B) data which were originally collected with the aim of producing credit reports on businesses. Notice the main defects of these data (cf. e.g. Cochran 1981): since D&B files contain primarily those businesses which at some point in time requested credits, the sample over-represents the larger and more prosperous organizations. Those firms which did not contact institutions or banks for a credit will be less likely to enter the D&B data. Among these firms, there may be those which failed early and had no chance of requesting a credit. In short, we suspect that there is an incidental sample selection bias in these data (cf. Berk 1983). Considering the fact that populations of small firms generally exhibit high rates of organizational mortality, one should be very cautious when interpreting Bates's results.

A second difficulty is evoked by Bates's indirect approach towards constructing human capital measures. Since D&B data do not contain information about entrepreneurial human capital, this information is inferred from another data file, namely a census data set. From census data Bates generates aggregate human capital variables for certain industries. Consequently, it is impossible to analyse the relationship between human capital and profitability on the level of individual firms. In technical terms, human capital endowment is treated as a contextual variable of individual firms. Therefore, there is a risk of getting trapped in ecological fallacies.

One basic proposition of human capital theory with regard to labour market phenomena is that the timing of investments in human capital will be concentrated on younger age groups. This is because investments in young people will, in general, have higher total benefits. Notice first that there is a longer period for the collection of returns from investments (education). Second, opportunity costs (foregone earnings) are generally lower in the case of younger people. Mincer (1974: Ch. 5) uses a deductive approach to derive concrete specifications of regression equations from human capital theory and other plausible empirical assumptions. One important deduction concerns the shape of age/earnings profiles. *Age/earnings profiles tend to be concave*, i.e. earnings of young workers are low

but rise rapidly when they begin to collect returns on training investments, and finally they become flatter as workers cease to invest in training. It may even be the case that older workers (in the aggregate) are somewhat less productive because their skills have depreciated. Given this, earnings profiles should show a maximum for median age groups.

The basic assumption we want to use in our application of the human capital approach concerns the relationship between human capital endowments of business founders and their productivity as firm owners. We propose that there is a positive (linear) relationship between the earnings capacity of entrepreneurs as measured by their human capital and the risk of organizational mortality. If this proposition holds true, the relationship between entrepreneurial age and organizational mortality should be concave (analogous to the common age/earnings profile). Notice that this prediction is distinct from previous hypotheses in the field (e.g. Bates's argument).

General Human Capital and Organizational Mortality

The argument about human capital as a determinant of organizational mortality may be specified in several ways. First, we point out possible effects of *general* human capital. Consider a population of would-be entrepreneurs who set up a business and continue, or start, a career as self-employed workers. According to human capital reasoning, these people are endowed with a human capital stock which has been created through general schooling and on-the-job training in previous occupational positions. There may of course be entrepreneurs who did not receive any relevant general on-the-job training (e.g. former housewives), but we can expect these cases to be rare. In the labour market, general human capital endowments are valued by a certain wage rate corresponding to the respective marginal productivity. Furthermore, let us assume that the *age/earnings profile has a concave shape*.

For our central argument it is decisive that there is a certain correspondence between labour market productivity and productivity as an owner of a business. Notice that this does not necessarily mean that general human capital (such as learning and experience in an employment relation) can be transformed without 'loss' into a corresponding productivity as an entrepreneur. Such an assumption does not seem plausible, since an owner-career obviously requires skills and knowledge (e.g. strategic decision-making, leadership activities) which are quite specific to the self-employment role. Assume for the moment that these specific skills are uniformly distributed among entrepreneurs. Then our argument requires that in the aggregate we can *ceteris paribus* observe *a positive (linear) relationship between earnings capacity on the labour market and productivity as an entrepreneur*, that is profitability of the firm. By 'ceteris paribus' we imply that ecological conditions, resource investments, organizational structure etc. are held constant.

Second, we assume a specific relationship between profitability and

organizational mortality. It seems intuitively plausible to assume that organizational productivity fosters survival. *The higher an organization's profitability the lower the risk that the firm will be disbanded*. By stating this assumption we ignore opportunity cost considerations within the self-employment role. Situations could arise in which entrepreneurs do not continue their business, even though in terms of absolute profits they are better off than other entrepreneurs. They may take this action because more attractive opportunities have become available to them (e.g. to switch into a well-paid employment relation).

These assumptions establish our first empirical *hypothesis* H_1: There is a *concave relationship between entrepreneur (founder) age and organizational mortality*, that is, the risk of organizational disbandment is lowest for median age groups.

Furthermore, we point out that the effect of general human capital on organizational mortality may be more complicated due to interaction effects with branches of industry. It is generally known that there are industries which require a high level of industry-specific experience. The difference between manufacturing and small retailers may be a case in point: we propose that in manufacturing there is a higher proportion of entrepreneurs with industry-specific labour market (or entrepreneurial) experience than in the retail business. Therefore, as our second *hypothesis* H_2, we suggest that *human capital effects should be more prominent in industries where a larger proportion of the entrepreneurs have experienced a career within that particular industry*.

Specific Human Capital and Organizational Mortality

In addition to effects of general and industry-specific human capital we want to consider consequences of investments in firm-specific training. Specific training is defined 'as training that has no effect on the productivity of trainees that would be useful in other firms' (Becker 1975: 26). Of course, no training is completely specific, but it is obvious that successful business start-ups require training (most of it learning by doing) or investments of a transaction-specific kind (e.g. investments in social ties and in social relations of mutual trust with employees, suppliers or customers) which may not have much value to the entrepreneur if the business has to be eventually disbanded. In the previous passages we have assumed a uniform distribution of those investments among different age groups. At this point, we question this assumption.

Becker (1975) argues that both rational firms and rational workers will only invest in specific training if there are mechanisms which enforce a long-term relationship between employer and employee. A self-employed individual, however, can be conceived as being simultaneously an employer and employee. A small entrepreneur is, so to speak, 'principal' and 'agent' within one person (cf. Thaler and Shefrin 1981 for a general analysis of self-control in such terms). As a matter of self-control, an entrepreneur has to invest in his own specific training. Direct and

opportunity costs of such training are reduced profits and/or a reduced personal income during the initial phase of business. Human capital theory predicts that the larger the investment the larger the expected stability of the firm.

Prima facie, the expected stability of a firm varies with the expected length of an entrepreneur's future working life. Therefore, the relationship between entrepreneurial age and specific investments should be negative. This being the case, one would expect that the youngest entrepreneurs would invest the most in specific training.

Contrary to this reasoning, we would like to consider findings from search- and matching-theoretic approaches (cf. Mortensen 1988 for a useful survey): theoretical reasoning, as well as the evidence, reveal that there are higher turnover rates among younger workers (in the period after first entry into the labour force). Younger workers lack experience within occupational roles, they exhibit considerable uncertainty about their own talents and productivity, and therefore hesitate to form a stable job match early in their career. We propose drawing an analog between the labour market and self-employment behaviour at this point too: if *younger entrepreneurs* are subject to the process just outlined, they do not expect a stable match with their business and therefore *invest less in specific human capital* than older entrepreneurs. In conclusion, we argue that investments in specific training are not distributed uniformly but are inversely U-shaped in relation to entrepreneurial age. *These effects* therefore *accentuate the effects of general experience* described above.

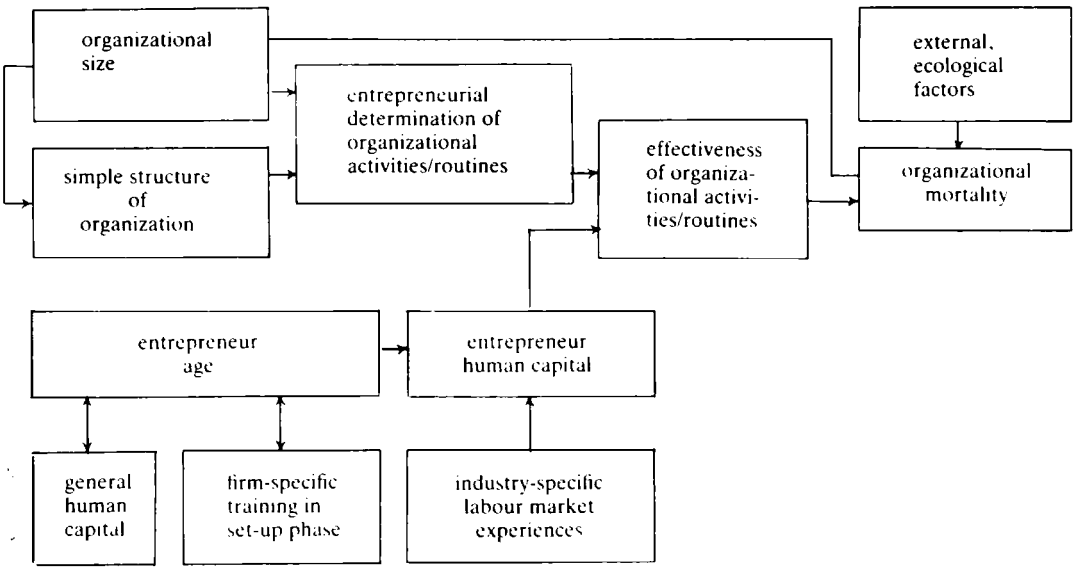
A final summary of our theoretical discussion is given in Figure 1. Organizational mortality of small firms varies with ecological and other variables (such as industry, location, etc.). In addition, some variation can be attributed to individual factors. This, in particular, will hold for very small firms since within those organizations entrepreneurial discretion with respect to organizational routines and activities is substantial. These organizations can be described by pointing to their 'simple structure' (Mintzberg). With regard to human capital, we suggest using entrepreneurial age as a proxy both for the amount of general human capital due to previous experience and for investment in firm-specific training. Notice that the arrows in Figure 1 should be interpreted with caution. They do not represent simple causal links or monotonous relationships. Entrepreneurial age should not be considered as a causal factor but as an indicator variable for human capital endowment. There are certain interaction effects, e.g. between industry and age. The expected shape of the survival/death rate is a concave/convex function of founder age.

Empirical Tests

Data

For an empirical test of the hypotheses discussed above archival data are used. These data cover the complete set of new firm registrations in

Figure 1 Diagrammatic Sketch of Theoretical Argument



manufacturing, construction, trade and services in the area of Munich and Upper Bavaria (West Germany) for the period 1980–1984. As in other parts of West Germany, people who want to open up a new business in Munich and Upper Bavaria have to register at the local Chamber of Commerce. This registration procedure requires founders to provide some basic information about their business, namely, among other things, industry, legal form, number of employees, and the exact date of their founding. If the business happens to be disbanded some time later, the Chamber of Commerce closes the record and notes the date of de-registration. Given the date of registration and the date of de-registration (if there was a de-registration), the data have the structure of right-censored event-history or survival data. We know the exact survival time of those businesses which were de-registered up to the end of our observation period (31 Dec. 1984). On the other hand, those businesses which survived the period of observation are right-censored, i.e. we do not know the exact survival time, but only the minimal time. Right-censored cases can be dealt with adequately by using statistical techniques of event-history analysis. Compared to other German data about business registrations (e.g. Szyperski and Kirschbaum 1981; Clemens and Friede 1986), the Munich data have the great advantage that the local Chamber of Commerce directly connects the registration and de-registration events for individual firms (not merely in the aggregate). This enables an analysis of organizational mortality on the basis of a large data set.

The complete set of new business registrations in Munich and Upper Bavaria in the period 1980–1984 amounts to nearly 120,000 cases (for a more detailed description of the data see Schüßler and Voss 1988; Schüßler

and Wilkens 1988). However, in the following empirical analysis we do not use all registrations, but only those having the legal status of 'small traders' (*Kleingewerbetreibende*, as defined by German law). The main reason for excluding all other legal forms (e.g. general or limited commercial partnerships) is that the data do not include any information about the person who founded these legal forms. For small traders, the data set includes the age of the founder, and this information will be central in our following analysis. Important control variables are the number of employees at the time of founding, industry, regional location, and year of founding.

The reduced data set comprises 78,441 small traders who started a new business in the period 1980–1984 and have given valid information as to their age (between 18 and 65 years). The average age of these business founders is 34 years (median 33 years, mode 27 years). 21 percent of all founders are younger than 26 years, 39 percent are between 26 and 35 years of age, 28 percent between 36 and 45, 9 percent between 46 and 55, and 3 percent are older than 55 years. There are more young founders in retailing and wholesaling than in manufacturing, where age is above the general average. Furthermore, the age of those founders who had at least one employee at the time of registration is higher than the age of those working completely for themselves.

Results

A first insight into our results is given by Table 1. Besides the just mentioned values of average age of the founders (column 1), this table shows (in column 2) 25 percent-quartile values of organizational survival times computed by the life-table estimator (a short description of the logic of the 'life-table estimator' is given in the Appendix). With respect to the total set of 78,441 newly founded businesses, we can see that it took only one and a half years for 25 percent of the firms to be de-registered, i.e. to go out of business. Grouping the data according to industry, it emerges that survival times of manufacturing firms are longer than those of trading firms. Notice that there is a positive (ecological) correlation between mean founder age in an industry and length of survival time. Similarly, survival times of foundings having one or more employees are longer than survival times of firms in which the founder works for himself, i.e. without any employees. Again, there is a positive relationship between survival time and average founder age. These correlations between survival times and organizational size on the one hand, and industry class on the other hand, may be treated as a first hint to the causal relevance of human capital endowment. This is so, because it may be argued that (1) on average, foundings in manufacturing are linked to more human capital than foundings in trading, and that (2) on average, foundings with employees are usually related to higher levels of entrepreneurial human capital than foundings without employees. Of course, the evidence that manufacturing firms and firms with employees survive longer can only be seen as a first hint

Table 1
Average Age of Founders and Organizational Survival Times (25 percent-quartile values based on life-table estimates)

	Average Age of Founders (in years)	Time Taken for 25% of the firms to go Out of Business (in months)	No. of Cases
All	34.0	18.2	78,441
Industry			
Manufacturing	35.1	24.6	2,793
Construction	34.3	19.6	1,128
Service Sector	34.1	20.0	36,553
Retail/Wholesale	33.7	16.8	37,221
No. of employees*			
No employees	34.2	18.5	6,886
One or more employees	36.1	20.7	3,873

* Only 14 percent of all small traders gave exact information about the number of their employees at time of founding. 86 percent are classified by the Chamber of Commerce into the broad category '0–10 employees'. The Chamber also puts those founders with no response with respect to 'no. of employees' into this category. Thus, we are constrained to exclude those 86 percent in all analyses which use the number of employees as a control variable. 'No employees' means that the founder works completely for himself.

to the relevance of human capital endowment. Several other factors (e.g. differing financial resources) may explain these findings. Similar to Bates, we can use results of other studies to supplement our findings. Such studies (e.g. Szyperski et al. 1979; Szyperski and Kirschbaum 1981; Clemens and Friede 1986; Weitzel 1986) show, for example, percentages of female, non-German, and unemployed founders in different industries. Connecting these results with our information about survival times in different industries, we arrive at an overall picture that firms in industries with high percentages of female, non-German, and unemployed founders have shorter life-spans. All this at least supports the contention that human capital is a variable which is worth investigating further by means of organizational mortality analyses.

Our main hypothesis H_1 stated that — analogous to the shape of age/earnings profiles — survival times of firms grouped by founder age should follow a concave pattern. Actually, this hypothesis is fully confirmed by our data. Based on life-table estimates, Figure 2 presents survivor functions of five different age groups of founders. It can be seen that the process of de-registration takes place most quickly for the youngest age group (18–25 years), i.e. the percentage of businesses still in existence after a certain time period decreases very rapidly. The age group between 26 and 35 years follows in second place. Survival chances are best for firms which have founders in the age groups 36–45 and 46–55 years. In the oldest group of founders, however, the average survival time of firms is somewhat shorter again.

Thus, *founder-age-specific survival times* of newly registered firms show an *inverse u-shaped pattern*. For the five age groups in Figure 2, 25 percent-quartile values of survival times (i.e. the lengths of time in which

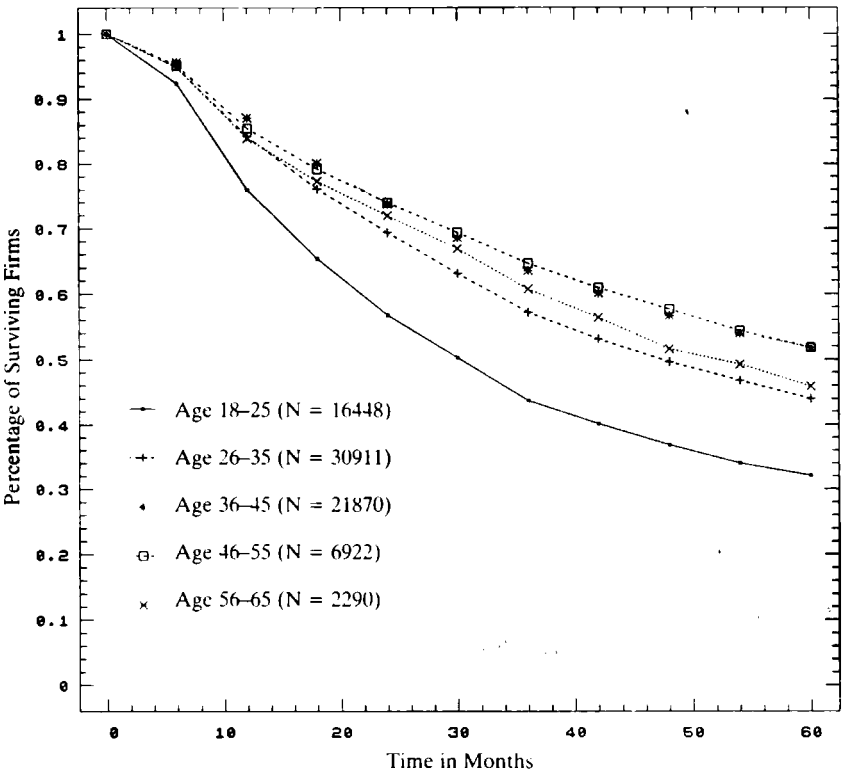


Figure 2
Percentages of Surviving Firms Founded by People in Different Age Groups (survivor functions)

25 percent of the businesses were de-registered and went out of business) are 12.6, 19.0, 22.8, 22.8, and 20.6 months. If we look at the founder-age-specific survivor functions in different industries, the concave pattern is normally preserved. The same is true when firms are grouped according to number of employees at the time of founding. To give an illustration of the concave pattern, Figure 3 displays the 25 percent-quartile values of survival times for the four industries which were used in Table 1. The construction industry is the only one that does not completely match the profile of the inverse u-shaped pattern. The small number of construction firms in the two highest age groups of founders (n = 101 for age group 46–55 years, and n = 21 for age group 56–65 years) may be responsible for this result. Nevertheless, the profile for construction firms can still be said to be concave.

An interesting additional finding emerges as we examine the 'hazard functions' for the five different age groups of founders. These hazard functions (which can be derived from the non-parametric survivor functions) specify the conditional probabilities that a firm will be de-registered in the next (very short) time interval given that there was no de-registration up to the beginning of this interval. For all five age groups of

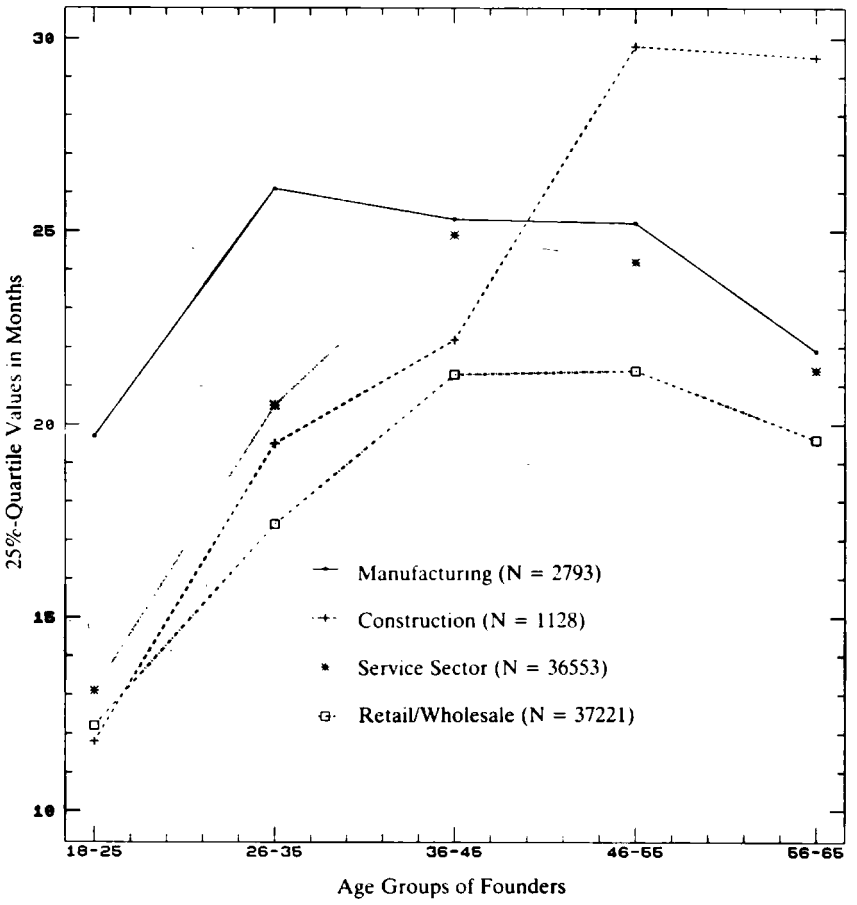


Figure 3
Survival Times of Firms Founded by People in Different Age Groups and in Different Industries (25 percent-quartile values, i.e. time in months taken for 25% to go out of business)

founders the hazard functions in Figure 4 show first an increasing, and then a decreasing mortality rate. The risk of de-registration is maximal in the second half of the first year. This pattern of the hazard curves contradicts the most common version of the well-known liability-of-newness hypothesis (e.g. Freeman et al. 1983). The liability-of-newness hypothesis states that very young organizations exhibit the highest mortality rate, and that right from the beginning the risk decreases monotonically. Given the patterns in Figure 4, which show first an increase and then a decrease, this version of the liability-of-newness hypothesis is not confirmed in our data. There seems to be, so to speak, a 'honeymoon period' (Fichman and Levinthal 1988) for new organizations, and more of a liability-of-adolescence than a liability-of-newness period. The low mortality rate in the first months points to a period of probation where the founder invests a lot of effort into the new firm, and customers give a certain credit to the newcomer (for a more detailed discussion of the liability-of-newness hypothesis based on the Munich data, see Schüßler 1988).

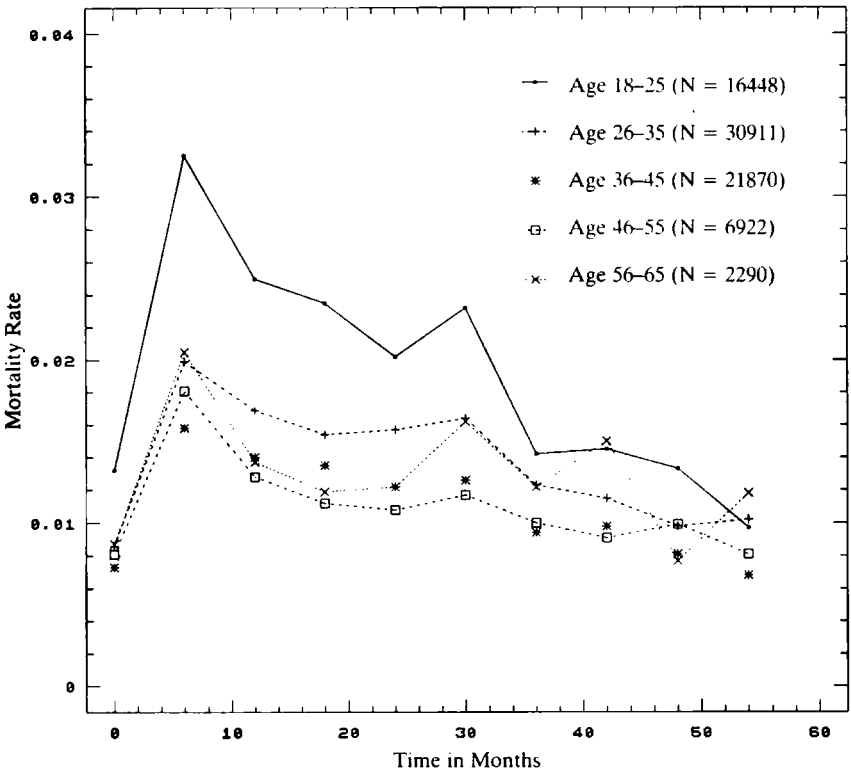


Figure 4
Mortality Rate of Firms Founded by People in Different Age Groups (hazard functions)

The results discussed so far are mainly based on bivariate analyses and on simple life-table estimates. From these, we arrived at a confirmation of the argument that survival times of firms increase in the first place, and then decrease with increasing age of the founder. For a more rigorous test, however, it seems appropriate to refer to parametric hazard rate models which allow for a multivariate control of variables (for some comments on the rationale of 'hazard rate models', see our Appendix).

In the context of hazard rate models, our hypothesis H_1 can be expressed as the expectation that the effect of 'age of the founder' on the mortality rate $r(t)$ is negative; the effect of the additional variable 'squared age of the founder' is, however, positive. This specification of the age variable is analogous to the well-known specification of the variable 'work experience' in human capital income functions (cf. Mincer 1974). Thus, we do not expect a linear relationship between age of the founder and mortality risk of a firm, but a non-linear relationship. The squared age of the founder term exactly captures this expectation. Because hazard rate models do not use the survival time, but the mortality rate as the dependent variable, we have to switch the sign of our argument, i.e. with increasing age of the founder the risk of a de-registration should first decrease and then increase (*convex pattern of the mortality rate*).

Like other analyses of organizational mortality (e.g. Carroll 1983), we use two types of parametric hazard rate models, namely the constant rate (exponential) model and the Makeham model. These models have the form:

$r(t) = \exp(\alpha)$ (constant rate model)

$r(t) = \exp(\alpha) + \exp(\beta) \exp(\gamma t)$ (Makeham model)

α, β, and γ are vectors which — if we bring in covariates x_i — can be specified by:

$$\alpha = a_0 + a_1x_1 + \ldots + a_nx_n$$

$$\beta = b_0 + b_1x_1 + \ldots + b_nx_n$$

$$\gamma = c_0 + c_1x_1 + \ldots + c_nx_n$$

In the case of the Makeham model we have to decide in which of the three vectors to include the covariates. In accordance with most applications of the Makeham model, we choose an inclusion into vector β; vector α simplifies to $\alpha = a_0$, and vector $\gamma = c_0$.

Table 2 presents the results of our analyses. For both types of models (constant rate and Makeham) we estimate in a first step (M1 in Table 2) an equation which includes as control variables 'regional location' (Munich area, other towns in Upper Bavaria, rural areas), 'industry' (manufacturing, construction, service sector, retail/wholesale), and 'year of founding' (1980–1984). In a second step (M2 in Table 2) we add the (interval-scaled) variable 'number of employees at time of founding'; this, however, is coupled with a sharp reduction in the number of cases, because more than 80 percent of all small traders in our data set cannot be classified on this variable.

Independent of the type of model (constant rate or Makeham) and independent of the set of covariates (exclusion or inclusion of number of employees at time of founding), it turns out that both founder-age variables, the simple and the squared term, show highly significant effects in the expected directions. Age of the founder has a negative, and squared age a positive effect on the mortality rate. Based on these results *we can conclude* that, even after controlling for other factors affecting the survival chances of firms, *there is a convex founder-age-mortality profile and, vice versa, a concave founder-age-survival profile*. Thus, multivariate analysis leads to a result which can be qualified as a further support of the central argument of this article.

Even though we do not want to comment on the other covariates of our models in Table 2, at least one further result deserves mentioning: The constant term c_0 of our Makeham models does not show positive, but negative time dependence. This contradicts most previous research which tries to establish the liability-of-newness argument. As we have already

Table 2
Effects of Different Covariates on Risk of Mortality: Beta-coefficients of Parametric Hazard Rate Models

Covariates	Constant Rate Models M1	Constant Rate Models M2	Makeham Models M1	Makeham Models M2
Entrepreneurial age				
Age	−0.107**	−0.111**	−0.110**	−0.113**
	(28.07)	(9.83)	(17.57)	(10.04)
$Age^2/100$	0.118**	0.130**	0.121**	0.132**
	(23.11)	(8.77)	(16.42)	(8.96)
Regional location				
Munich area	0.165**	0.252**	0.169**	0.256**
	(10.43)	(5.35)	(9.44)	(5.43)
Other towns	0.142**	0.041	0.146**	0.043
	(6.10)	(0.58)	(5.94)	(0.61)
Industry				
Construction	0.210**	0.197	0.214**	0.196
	(3.57)	(1.09)	(3.53)	(1.09)
Service Sector	0.126**	0.307**	0.129**	0.310**
	(3.55)	(2.96)	(3.49)	(2.99)
Retail/Wholesale	0.257**	0.175	0.262**	0.178
	(7.24)	(1.66)	(6.69)	(1.69)
Year of founding				
1981	0.175**	0.200**	0.227**	0.264**
	(9.68)	(2.86)	(9.99)	(3.74)
1982	0.333**	0.457**	0.435**	0.588**
	(18.66)	(8.00)	(14.37)	(9.62)
1983	0.457**	0.570**	0.608**	0.763**
	(23.37)	(9.77)	(16.07)	(11.47)
1984	0.279**	0.494**	0.475**	0.747**
	(10.57)	(6.92)	(12.32)	(9.05)
No. of employees		−0.009		−0.008
		(1.50)		(1.53)
Constants				
a_0	−2.599**	−2.884**	−10.940	−16.160
	(33.27)	(12.25)	(0.26)	(0.16)
b_0			−2.798**	−3.151**
			(35.30)	(13.16)
c_0			0.009**	0.012**
			(13.89)	(6.511)
Chi-squared	2577.2	293.1	2878.1	335.1
df	1	12	13	14
% censored	64.9	70.7	64.9	70.7
No. of cases	77,005	10,617	77,005	10,617

Reference categories: foundings in rural areas (regional location); manufacturing (industry); 1980 (year of founding).
t-values in parentheses; * significant (5 percent-level); ** highly significant (1 percent-level).
Model estimates by using the program RATE (Tuma 1979).

seen in Figure 4, the usual liability-of-newness hypothesis does not find confirmation in our data insofar as there is first a period of an increasing mortality rate. Obviously, this short period dominates the estimate of c_0. If we had a longer observation period (i.e. not just five years), c_0 may have a tendency to become negative.

Based on human capital theory, an additional hypothesis was formulated in

Section 1. According to our hypothesis H_2, human capital effects in industries which require a high level of industry-specific experiences should be stronger than the corresponding effects in industries which require less industry-specific experience from founders. An approximate test, at least, of this hypothesis can be made in the following way: we assume that industry-specific experiences of founders are necessary prerequisites in manufacturing (and here, especially, in electrical and mechanical engineering) and in the service sector of consultation (e.g. tax counsellors, company advisers). On the other hand, specific experiences of founders presumably are less urgent in the retail trade, for wholesalers, in the transport business, and for restaurant owners. Starting with these assumptions, we expected stronger effects of the founder-age variables in the first mentioned business sectors than in the second mentioned class of industries. The effects of the founder-age variables in separate models for the six different branches are shown in Table 3. Due to space limitations, we do not give the coefficients of the control variables (regional location and year of founding) of the branch-specific equations.

There is a consistent tendency for the coefficients of 'age of the founder' and 'squared age' to be stronger in the two industries 'electrical/mechanical engineering' and 'consultation' than in the four industries 'retail', 'wholesale', 'transportation', and 'restaurants'. Again, this result is independent of the type of model used (constant rate or Makeham). Regrettably, we do not have (or do not know of) quantitative measures for proving statistically whether or not our profiles differ significantly between industries in their degree of convexity (simple statistical tests for differences between coefficients in Table 3 cannot answer the question as to whether our industry-specific profiles differ in their degree of convexity). However, to give at least a visual impression of the convex founder-age-mortality profiles, Figure 5 displays the profiles for electrical/mechanical engineering and consultation, and Figure 6 shows the profiles for the retail and wholesale trade. The profiles in Figure 5 and 6 are based on the parameter estimates of the constant rate models in Table 3; for the control variables we use the mean values. The different ages of the founders are given on the x axis, and the y axis shows the mortality rate.

Concluding Remarks

The main argument of this article was that human capital endowment of entrepreneurs (founders) has an effect on the profitability of newly established firms, and on their chances of organizational survival (which can be seen as a minimal criterion of success). Referring to human capital theory, we first tried to elaborate and to specify this argument in a theoretically oriented section. Two testable hypotheses could be derived concerning the relationship between entrepreneurial age and organizational survival times. An empirical test of these hypotheses — based on a

Table 3
Effects of Entrepreneurial 'Age' and 'Squared Age' in Six Different Industries: Beta-coefficients of Parametric Hazard Rate Models

Branch of Industry	Constant Rate Models Coefficients of		Makeham models Coefficients of	
	Age	Age^2/100	Age	Age^2/100
Electrical/mechanical engineering (N = 722)	−0.124** (2.74)	0.162** (2.75)	−0.249* (2.42)	0.333* (2.47)
Consultation (N = 9178)	−0.143** (11.01)	0.163** (9.47)	−0.148** (11.34)	0.168** (9.75)
Retail (N = 22638)	−0.102** (14.57)	0.115** (12.22)	−0.104** (14.91)	0.117** (12.51)
Wholesale (N = 9692)	−0.086** (8.64)	0.087** (6.18)	−0.089** (8.97)	0.090** (6.42)
Transportation (N = 5808)	−0.111** (8.43)	0.125** (6.97)	−0.111** (8.46)	0.126** (7.00)
Restaurants (N = 8046)	−0.091** (7.59)	0.100** (6.53)	−0.093** (7.76)	0.102** (6.65)

Additional covariates in all 12 equations are regional location and year of founding. *t-values* in parentheses; * significant (5 percent-level); ** highly significant (1 percent-level). *Model estimates* by using the program RATE (Tuma 1979).

large data set of business registrations in West Germany — resulted in a confirmation of both hypotheses. We observed a *concave founder-age-survival profile* and a *convex founder-age-mortality profile*, and the shape of these profiles seems to be *more pronounced in branches requiring more branch-specific experience* from founders.

Of course, we have to concede that these encouraging findings rest upon a set of assumptions which could not be tested with our data. Contrary to comparable studies (e.g. Bates 1985), however, at least some shortcomings have been avoided. The data base is not confronted with an incidental sample selection bias because less successful and short-lived firms are fully included. By using statistical techniques of event-history analysis it was assured that right-censored cases were dealt with adequately. Even if human capital resources could only be measured indirectly by the proxy 'age of the founder', this measurement is more direct than that of Bates. There is no doubt that a data set containing more detailed information about the human resources of entrepreneurs (general education, occupational training, experiences in previous jobs, prior self-employment experiences, etc.) would be desirable and necessary. Lacking this information, several alternative explanations of the observed founder-age effects cannot be ruled out. One alternative to a human capital explanation is offered by *search-* and *matching-theories*, as mentioned above. However, arguments based on these theories may be consistent with a human capital perspective. A more fundamental alternative could build on considerations recently presented by March (1988). According to March, different *risk preferences* of individuals lead to different organizational decisions and to different organizational survival chances. Using a framework which

Figure 5
Mortality Rate of Firms Founded by People of Different Ages in Electrical/ Mechanical Engineering and Consultation

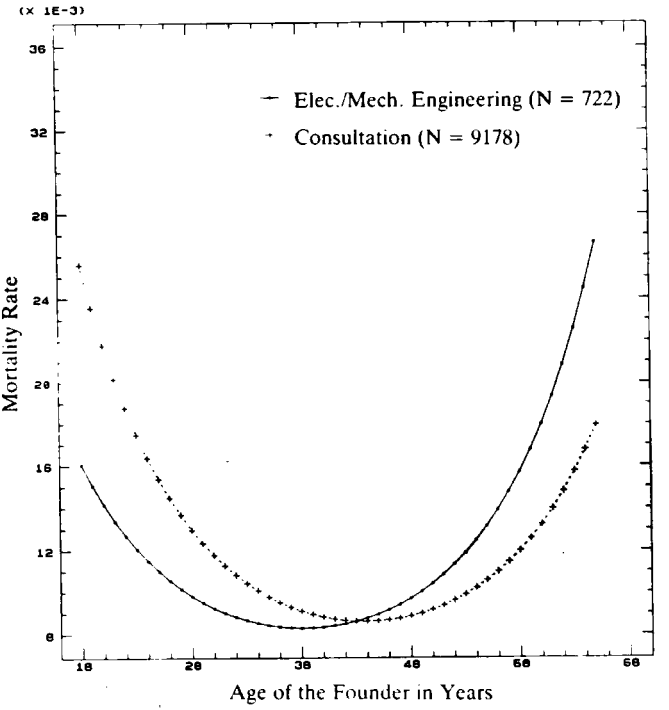
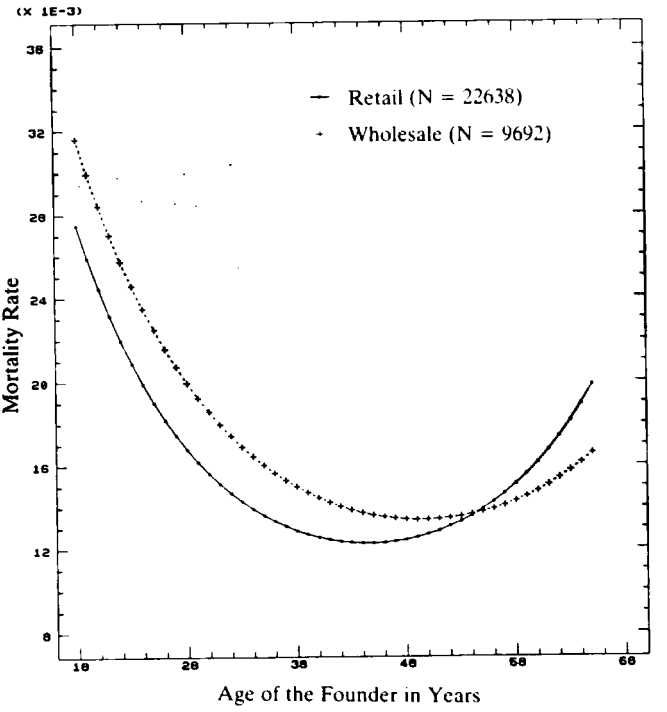


Figure 6
Mortality Rate of Firms Founded by People of Different Ages in Retailing and Wholesaling



accentuates risk preferences, similar or even identical hypotheses like those above might be derived by linking differences in risk preferences to different age classes. The question, however, is whether such an approach can be elaborated in a more plausible and less *ad hoc* way than a human capital perspective. Still another interpretation has been mentioned by one of the reviewers: entrepreneurship might itself be considered as a population ecology phenomenon. According to this idea, one might conjecture that successful entrepreneurs will have experienced situations in which firms go out of business. Thus, most young entrepreneurs are first-time players, whereas middle aged entrepreneurs are more experienced. The older age group may be composed of early retirees or displaced persons who lack entrepreneurial experience. Therefore, age may be a proxy for prior experience in entrepreneurship.

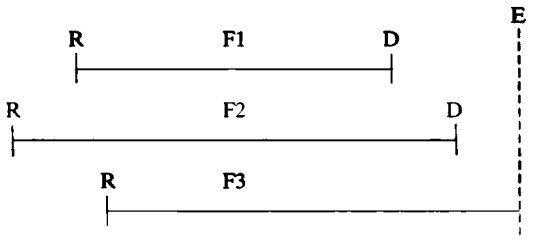
Given our results with regard to labour market politics, an important conclusion may emerge. In most industrialized societies, in West Germany in particular, labour market conditions tend to be more problematic for the youngest and the oldest groups of working people. Those groups also exhibit the highest tendency to business failure. Therefore, it seems doubtful whether entrepreneurship and self-employment can be effective antidotes against unemployment or disadvantageous labour market positions.

Appendix

Comments on Statistical Methods Used in the Analyses

Life-table Estimator

Using the life-table estimator (see, e.g., Kalbfleisch and Prentice 1980; Diekmann and Mitter 1984), we can analyse survival times of newly founded firms. Let us take three firms F1, F2, and F3; R = date of registration, D = date of de-registration, and E = end of observation period:



We know the exact survival times of F1 and F2. F3, however, is right-censored, i.e. this firm had no de-registration up to the end of the observation period. Applying the life-table estimator, we can derive the empirical survivor function and the empirical hazard function. Taking right-censored cases into account, the survivor function shows which percentages of firms survived at each time t after founding. The hazard function, on the other hand, displays the risk of dying, the failure rate, or simply the rate at each time t, i.e. the instantaneous probability of failing at time t, given that failure had not occurred before time t.

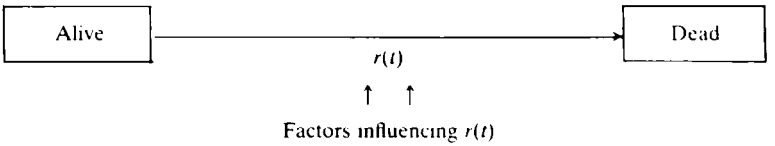
Hazard Rate Models

Hazard rate models (see, e.g., Diekmann and Mitter 1984; Tuma and Hannan 1984; Blossfeld et al. 1986) take the just mentioned failure or mortality rate $r(t)$ as a dependent variable. $r(t)$ is formally defined as:

$$r(t) = \lim_{\Delta t \to 0} \frac{q\ (t,\ t + \Delta t)}{\Delta t}$$

q is the conditional probability that a unit which did not change its state until t (i.e. had no de-registration) will have an event (i.e. a de-registration) in the next, very short time interval Δt. By referring to the limit, $r(t)$ makes the time interval Δt infinitesimally small.

We can visualize the logic of hazard rate models by the following simple diagram:



At time $t(0)$ all units (firms) are alive. As time passes, some units die, i.e. change their state from 'alive' to 'dead'. This constitutes $r(t)$. Hazard rate models allow for a multivariate analysis of factors (independent variables or covariates) affecting $r(t)$. In contrast to semi-parametric models which make no assumption about the time path of $r(t)$, parametric models assume a certain time path of $r(t)$. The constant rate model, e.g., assumes that $r(t)$ is constant over time. Other models, e.g., the Weibull, Gompertz, or Makeham model allow for declining or increasing risks over time.

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References

Aldrich, Howard
1978 *Organizations and environments*. Englewood Cliffs: Prentice-Hall.

Bates, Timothy
1985 'Entrepreneur human capital endowments and minority business viability'. *Journal of Human Resources* 20: 540–554.

Becker, Gary S.
1975 *Human capital*, 2nd ed. Chicago: University of Chicago Press.

Berk, Richard A.
1983 'An introduction to sample selection bias in sociological data'. *American Sociological Review* 48: 386–398.

Birch, David L.
1987 *Job creation in America*. New York: Free Press.

Blossfeld, Hans-Peter, Alfred Hamerle, and Karl Ulrich Mayer
1986 *Ereignisanalyse*. Frankfurt: Campus.

Bögenhold, Dieter
1985 *Die Selbständigen*. Frankfurt: Campus.

Bögenhold, Dieter
1987 'Selbständige im Beschäftigungssystem' in *Bildung und Beschäftigung*. A. Weymann (ed.), 317–333. Göttingen: Schwartz.

Borjas, George J.
1986 'The self-employment experience of immigrants'. *Journal of Human Resources* 21: 485–506.

Carroll, Glenn R.
1983 'A stochastic model of organizational mortality: Review and reanalysis'. *Social Science Research* 12: 303–329.

Carroll, Glenn R.
1984 'Organizational ecology'. *Annual Review of Sociology* 10: 71–93.

Carroll, Glenn R., and Elaine Mosakowski
1987 'The career dynamics of self-employment'. *Administrative Science Quarterly* 32: 570–589.

Clemens, Reinhard, and Christina Friede
1986 *Existenzgründungen in der Bundesrepublik Deutschland*. Stuttgart: Poeschel.

Cochran, A. B.
1981 'Small business mortality rates: A review of the literature'. *Journal of Small Business Management* (October): 50–59.

Diekmann, Andreas, and Peter Mitter
1984 *Methoden zur Analyse von Zeitverläufen*. Stuttgart: Teubner.

Fichman, Mark, and Daniel A. Levinthal
1988 'Honeymoons and the liability of adolescence: A new perspective on duration dependence in social and organizational relationships', *Mimeo*. Carnegie-Mellon-University.

Freeman, John, Glenn R. Carroll, and Michael T. Hannan
1983 'The liability of newness: Age dependence in organizational death rates'. *American Sociological Review* 48: 692–710.

Fuchs, Victor R.
1982 'Self-employment and labor force participation of older males'. *Journal of Human Resources* 17: 339–357.

Granovetter, Mark
1984 'Small is bountiful: Labor markets and establishment size'. *American Sociological Review* 49: 323–334.

Hannan, Michael T., and John Freeman
1989 *Organizational ecology*. Cambridge, Mass.: Harvard University Press.

Kalbfleisch, John D., and Ross L. Prentice
1980 *The statistical analysis of failure time data*. New York: Wiley.

Kanter, Rosabeth M.
1977 *Men and women of the corporation*. New York: Harper and Row.

Klandt, Heinz
1984 *Aktivität und Erfolg des Unternehmensgründers*. Bergisch-Gladbach: Josef Eul.

Lazerson, Mark H.
1988 'Organizational growth of small firms: An outcome of markets and hierarchies?'. *American Sociological Review* 53: 330–342.

March, James G.
1988 'Variable risk preferences and adaptive aspirations'. *Journal of Economic Behavior and Organization* 9: 5–24.

Miller, Danny, and Cornelia Dröge
1986 'Psychological and traditional determinants of structure'. *Administrative Science Quarterly* 31: 539–560.

Miller, Danny, and Jean-Marie Toulouse
1986 'Chief executive personality and corporate strategy and structure in small firms'. *Management Science* 32: 1389–1409.

Mincer, Jacob
1974 *Schooling, experience and earnings*. New York: N.B.E.R. and Columbia University Press.

Mintzberg, Henry
1979 *The structuring of organizations*. Englewood Cliffs: Prentice-Hall.

Mintzberg, Henry
1983 *Power in and around organizations*. Englewood Cliffs: Prentice-Hall.

Mortensen, Dale T
1988 'Matching: finding a partner for life or otherwise'. *American Journal of Sociology* 94 Suppl.: S215–S240.

Pfeffer, Jeffrey
1977 'The ambiguity of leadership'. *Academy of Management Review* 20: 104–112.

Picot, Arnold, Ulf-Dieter Laub, and Dietram Schneider
1989 *Innovative Unternehmensgründungen*. Berlin: Springer.

Schüßler, Rudolf
1988 'The early death of organizations', *Mimeo*. Universität München.

Schüßler, Rudolf, and Thomas Voss
1988 'Bedingungen des Überlebens von Kleinbetrieben' in *Technik und Flexibilisierung*. SFB 333 (ed.), 101–114. München: Universität München.

Schüßler, Rudolf, and Frauke Wilkens
1988 'Deskriptive Ergebnisse der Analyse der Gewerbemeldungen in München und Oberbayern von 1980–1984', *Mimeo*. Universität München.

Szyperski, Norbert, and Gunter Kirschbaum
1981 *Unternehmensfluktuation in Nordrhein-Westfalen*. Göttingen: Schwartz.

Szyperski, Norbert, Heinz Klandt, and Klaus Nathusius
1979 'Zur Person des Unternehmensgründers'. *Internationales Gewerbearchiv* 27: 1–16.

Thaler, R. H., and H. M. Shefrin
1981 'An economic theory of self control'. *Journal of Political Economy* 89: 392–406.

Tuma, Nancy B.
1979 'Invoking RATE', *Mimeo*. Zentrum für Umfragen, Methoden und Analysen e.V., Mannheim.

Tuma, Nancy B., and Michael T. Hannan
1984 *Social dynamics*. Orlando: Academic Press.

Weitzel, Günter
1986 *Beschäftigungswirkungen von Existenzgründungen*. München: IFO-Institut.

Williamson, Oliver E.
1975 *Markets and hierarchies*. New York: Free Press.

Willis, Robert J.
1986 'Wage determinants: A survey and reinterpretation of human capital earnings functions' in *Handbook of Labor Economics, Vol. I*. O. Ashenfelder, and R. Layard (eds.), 525–602. Amsterdam: North-Holland.