# The risk of growing fast

## Does fast employment growth have a negative impact on the survival rates of firms?

C.M. Hartog MSc
dr. J.M.P. de Kok
dr. Ir. H. Zhou

Zoetermeer, December, 2011

EIM
a member of Panteia

SCALES
SCientific AnaLysis of Entrepreneurship and SMEs
www.entrepreneurship-sme.eu

This research has been partly financed by SCALES, SCientific Analysis of Entrepreneurship and SMEs (www.entrepreneurship-sme.eu)

EIM Research Reports

| | |
|---|---|
| reference number | H201119 |
| Publication | December 2011 |
| number of pages | 36 |
| email address corresponding author | jko@eim.nl |
| Address | EIM<br>Bredewater 26<br>P.O. box 7001<br>2701 AA Zoetermeer<br>The Netherlands<br>Phone: +31(0)79 322 22 00 |

All the EIM research reports are available on the website www.entrepreneurship-sme.eu.

# Contents

# 1 Introduction

### *Firm size and firm growth*

Both firm survival and firm growth are important characteristics of firm dynamics. Firm *survival*, or rather its opposite firm exit, has two opposite economic effects. On the one hand, firm exit has various negative effects, including financial costs (such as unpaid bills and wages), unemployment and the depreciation of (firm-specific) human capital. On the other hand, firm exit is a necessary aspect of creative destruction (Schumpeter, 1934), where under-performing enterprises are replaced by new and innovative enterprises. Firm *growth* is important for generating jobs (Carree and Klomp, 1996). In particular fast growing firms are considered as the central drivers of job creation in the economy (Birch, Haggerty and Parsons, 1995; Henreksen and Johansson, 2008). The entry of such firms, their growth and decline, and their exit is at the core of economic dynamics (Coad and Hölzl, 2010).

Over the last two decades, determinants of firm survival and growth have been studied in various disciplines, such as economics, strategy, psychology, network theory and innovation, using either the firm or the individual as the unit of observation. Determinants such as the behaviour of individual entrepreneur, business strategy, the effects of firm size and age, R&D activities, productivity and export intensity, etc. have been intensively explored to determine their relationship with the probability of survival of the firm and firm growth (Begley and Boyd, 1987; McDougall, Robinson and DeNisi, 1992; Audretsch, Klomp, Santarelli and Thurik, 2004).

### *Research question*

Studies on firm survival and growth are no longer short in supply. These studies, however, tend to examine either firm survival or firm growth, but not whether these two aspects of firm dynamics may be related to each other. It is not unlikely that a relationship exists between these two aspects. In particular, if the size of the firm increases too fast, the management of the firm may not be able to react quickly enough and make necessary changes to the organization and management structure. The resulting mismatch between organisational size and structure may put the firm at risk of going bankrupt and lead to firm exit. In this study, we investigate the impact of fast employment growth on the survival of the firm. More precisely, our research question reads:

> *Do high employment growth rates in the recent past have a negative effect on firm survival?*

### *Policy relevance*

In the Netherlands, the share of fast growing firms is relatively small. This is considered as a disadvantage since fast growing firms account for a disproportionately large share of employment and revenue growth in the economy (Acs et al., 2008). The Dutch government has therefore taken various policy initiatives and measures to increase the share of fast growing firms. If high growth rates would have a negative effect on survival rates, it may not be enough to stimulate the number of fast growing firms and to enhance employment temporarily. It may be equally important to prevent fast growth from ending in fast decline.

*Outline*

The relationship between firm growth and survival has not received much attention in scientific publications. In chapter 2, we discuss existing literature on the possible effects of employment growth rates on firm survival. Data and research methodology are presented in chapter 3. The estimation results are presented in chapter 4, after which chapter 5 ends with a conclusion and discussion.

# 2 Possible effects of growth rates on firm survival

So far, researchers have not paid much attention to (the possibility of) the effect that employment growth rates may have on firm survival rates. There is, however, an abundance of literature on the separate subjects of firm growth and firm survival. In this chapter, we review some classical theories and discussions on firm growth and firm survival and their main determinants (including firm size and firm age). This review leads to some stylized facts, which together suggest that firm growth may indeed affect firm survival. First, however, we pay attention to the definition of fast growing firms.

## 2.1 Fast growing enterprises

When can an enterprise be considered to be fast growing? This not only depends on the growth rate, but also on the length of the time period during which the growth rate is determined, whether employment growth or turnover growth is measured, whether only organic growth is included or also growth that results from organisational mutations (such as mergers and take-overs), and whether (and how) the classification corrects for possible overrepresentation of small organisations.

One of the first definitions of fast growing firms was provided by Birch et al. (1995). They define a fast growing enterprise as "a business establishment which has achieved a minimum of 20% sales growth each year over the interval, starting from a base-year revenue of at least $100,000". More recently, the Dutch Ministry of Economic Affairs, Agriculture and Innovation defines fast growing firms as all enterprises with 50-1,000 employees at the start of the observation period that realized either an employment growth and/or turnover growth of at least 60% over a three year period (Donselaar, Erken and van den Heuvel, 2007)[1]. Compared to the earlier definition by Birch et al., this definition includes employment growth as well as turnover growth, it explicitly mentions that the growth rate should be determined over a three-year period, and it includes a lower threshold to correct for possible overrepresentation of small organisations[2].

According to the OECD, "All enterprises with average annualised growth greater than 20% per annum, over a three year period should be considered as high-growth enterprises. Growth can be measured by the number of employees or by turnover" (OECD, 2007, page 61). In addition, "If growth in the number of employees or turnover was due to mergers or take-overs, the enterprise in question should not be considered a high-growth enterprise." (OECD, 2007, page 62). This ensures that the group of fast growing enterprises is restricted to enterprises with an organic employment growth.

[1] This definition is also used in the annually executed EIM study 'International Benchmark Entrepreneurship' (e.g. Snel et al., 2010).

[2] A different solution that has also been applied to correct for this overrepresentation, is to calculate a corrected growth rate (such as the Birch-corrected growth rate).

A serious disadvantage of considering turnover growth is that changes in turnover will be partly related to factors that are not related to changes in the actual performance of enterprises, such as inflation[1] or changes in the product portfolio (for example, a retail enterprise that shifts its sales from low value products to the same quantity of higher value products). For these reasons, it is argued in an OECD working paper that the definition of fast growing firms should not be based on turnover growth (Ahmad, 2006, p. 57).

## 2.2 Firm growth

### *Gibrat's law*

The discussion on the relationship between firm growth, firm size and firm age has its origin in Gibrat's law (Audretsch et al., 2004). Gibrat's law states that the growth rate of a firm is independent of its initial size: the probability of a given growth rate (during a specific time interval, within a specific industry) is identical for all firms. However, empirical studies do not find supporting evidence (Becchetti and Trovato, 2002). Several studies show that smaller and younger firms show higher growth rates than their larger and older counterparts.

### *Firm growth and firm size*

Studies which incorporated different countries and industries indicate a negative effect of size on firm growth (Almus and Nerlinger, 2000; Bottazzi and Secchi, 2003; Calvo, 2006; Dunne and Hughes, 1994; Goddard, Wilson and Blandon, 2002; McPherson, 1996). Researchers who studied firm growth in different size classes suggest that Gibrat's law of size independence only holds for firms above a certain size threshold, of for instance 400 employees (Bigsten and Gebreeyesus, 2007).

The negative relationship between firm size and firm growth has been related to the concept of the minimum efficient size or MES[2]. The systematic decrease in a firm's growth rate along with its increased size may be a consequence of the firm's aim to reach the optimal scale of production that allows them to survive (Sutton, 1997). Small firms tend to operate at a production scale below the minimum efficient size and grow relatively fast to achieve this minimum efficient size (Audretsch et al., 2004; Yasuda, 2005).

### *Firm growth and firm age*

The negative effect of age on firm growth is consistently found among various countries and industries (Geroski and Gugler, 2004; Glancey, 1998; Liu, Tsou and Hammitt, 1999; Reichstein and Dahl, 2004; Robson and Bennett, 2000; Yasuda, 2005). The growth of young firms is often associated with improved chances of survival as well as learning effects and productivity growth associated with the firms approaching an efficient scale of operations.

[1] It is possible to correct for inflation, but in the case of international longitudinal data this could take much time.

[2] The minimum size at which cost-efficient production is possible.

## 2.3 Firm survival

The positive relationship between firm size and likelihood of survival is consistently found in empirical studies (Dunne, Roberts and Samuelson, 1989; Audretsch and Mahmood, 1994, 1995; Mata and Portugal, 1994; Mitchell, 1994; Geroski, 1995; Haveman, 1995; Sharma and Kesner, 1996; Sutton, 1997). The theoretical explanation of this positive relationship is grounded on the model of noisy selection (Jovanovic, 1982; Pakes and Ericson, 1998). The central feature of the model is the learning process about relative efficiency from actual market experience. The true ability of the managerial competence of entrepreneurs is only discovered subsequent to entry into the industry. Firms which are more efficient than others expand their scale of productive capacity whereas those less efficient firms will remain small and sub-optimal which may ultimately lead to exit (Agarwal and Audretsch, 2001). The larger the initial size of a firm, the more likely it is closer to the minimum efficient size which is needed to operate efficiently in a market, the less will be the cost disadvantage imposed by the size disadvantage. Thus compared to smaller firms, larger firms are less vulnerable and are more likely to survive (Audretsch and Mahmood, 1994, 1995).

The minimum efficient size varies considerably between sectors of industry. In industries with a large minimum efficient size it will be difficult for new firms to enter, and displacement is less likely to occur. On the one hand, only the optimal firms may exist in such industries, thus there may be a small number of sub-optimal firms which are potential exiters (Doi, 1999). On the other hand, in most industries the great majority of firms are sub-optimal. These firms can survive using alternative advantages to offset their disadvantages. Thus, the exit rate in those industries may also be reduced. Based on the sample of Japanese manufacturing industries over the period 1981-1989, Doi (1999) indicated an inverted U-shape relationship between the minimum efficient size and exit rate.

## 2.4 Stage models

A stream of literature from which we can borrow to establish the relationship between growth rates and firm survival, is the literature on stage models. Stage models focus on the generic problems organizations encounter during growth (Davidsson, Achtenhagen and Naldi, 2005). One of the frequently referred stage models is developed by Greiner (Greiner, 1972). Greiner (1972) claims that there are five distinct and distinguishable phases of organization development during the growing processes. Each of these phases requires a dominant managerial style and organization structure to achieve growth, and ends with a dominant managerial crisis which must be solved before further growth can continue. For instance, informal and frequent communication between CEO and employees is favourable during the early stage of the firm when it is small. As the firm grows, the scale of production increases and more knowledge is required. This leads to an increase in the number of employees. At a certain point, the workforce becomes so large that it cannot be managed informally anymore. A more effective managerial style and organization structure is required to achieve further development. A firm needs to make effective adjustment during its evolution in order to survive and grow.

Firms with a high employment growth are more likely to reach the end of their current organisational development phase, and thus are faced with a managerial crisis. In addition, it is conceivable that the intensity of this crisis is also larger,

because the underlying changes in the organisation occurred in a faster pace. This suggests that high employment growth rates may have a negative effect on firm survival rates.

## 2.5 Stylized facts on firm growth and firm survival

Two main stylised facts emerge from the existing literature: firm size is negatively related to firm growth and positively related to firm survival. This suggests a negative relationship between growth rates and survival rates: the population of small firms will show higher average growth rates and lower survival rates than populations of larger firms. This negative relationship does not imply a causal effect of firm growth on firm survival, but merely reflects that firm growth and firm survival have an opposite relationship with firm size. Notice that this negative relationship only applies at the aggregated level of size classes, but not at the level of individual firms[1].

At the level of individual enterprises, a different relationship between firm growth and firm survival may exist, where firm survival at time t may be partially dependent on firm growth prior to t. First of all, the models of noisy selection suggest that fast growth rates have a positive effect on a firm's survival rate (as long as the firm is operating below its minimum efficient size). Secondly, based on Greiner's model on organisation development we have argued that high employment growth rates may have a negative effect on firm survival rates, if fast-growing firms cannot adjust their managerial style quickly enough. Based on these two models, we formulate the following hypothesis: the relationship between firm growth prior to year t and firm survival during year t can be characterised by an inverted U-shaped relation. High growth rates have a positive effect on the survival rate of a firm, as long as the enterprise can manage the organisational consequences of the increasing firm size; once this threshold has been reached, higher growth rates may have a negative effect on firm survival.

In the following chapter, we discuss the data and methodology that we have applied to test this hypothesis. The results are presented in chapter four.

[1] The aggregate statistics of growth rates and survival rates are based on different samples: average growth rates are based on existing or surviving enterprises within each size class, while average survival rates are based on all enterprises.

# 3 Data and Methodology

## 3.1 Data sources

For this study we have combined various existing registrations regarding the enterprise population in The Netherlands. The main sources are business registration data from the Chambers of Commerce, employment data from the State Unemployment Insurance Agency, Production Statistics and the Survey on Employment and Wages of Statistics Netherlands. The resulting dataset (the *Longitudinal Enterprise Database 1993-1999*) includes annual employment information on almost all employer enterprises[1] of the Dutch business economy between 1993 and 1998. For each enterprise and for each individual year, information is available on the year of entry, mutations that took place (e.g. mergers, take-overs or other administrative mutations), and – in case of a firm exit – the year of exit and the main reason for exit (in particular, whether exit is due to actual firm death or because of other reasons such as mergers, take-overs or administrative reasons).[2]

## 3.2 Data characteristics

*Distinguishing firm status*

Each observation in the *Longitudinal Enterprise Database 1993-1999* represents a single enterprise in a single year. Each observation can be classified into one of the following mutually exclusive groups:

- Pre-entry: enterprise *i* does not exist yet in year *t*.
- Entry: enterprise *i* entered in year *t* and did not exit in year *t*.
- Continuous: enterprise *i* entered before year *t* and did not exit in year *t*.
- Exit due to firm death: enterprise *i* entered before year *t* and exited due to firm death in year *t*.
- Exit due to other reason: enterprise *i* entered before year *t* and exited due to a reason other than firm death in year *t*.
- Entry and exit in a single year: enterprise *i* both entered and exited in year *t*.
- Post-exit: enterprise *i* does not exist anymore in year *t*.

The year of exit of an enterprise is defined as the last year in which paid employment occurred. For the final year of our database (1999), the year of exit cannot be determined[3]. For the other years, the relative distribution of this classification (excluding pre-entry and post-exit) is presented in Table 1. On average, about 8% of all employer enterprises that reported economic activity in a specific year in the period 1993-1998 had started during that year (this includes enterprises that entered and exited in a single year). For this period, the exit rate is somewhat higher than the entry rate: on average, 9% of all employer en-

[1] Employer enterprises are enterprises with employees.

[2] More details on the data sources and the construction of the dataset can be found in Annex I.

[3] No information on paid employment is available for the year 2000.

terprises that reported economic activity in a specific year exited in that year (again including enterprises that entered and exited in a single year).

Table 1 Relative distribution of status of enterprise, for employer enterprises of the Dutch business economy, 1993-1998 (%)

| *Status* | *1993* | *1994* | *1995* | *1996* | *1997* | *1998* | *Aver-age* |
|---|---|---|---|---|---|---|---|
| Entry | 6.9 | 7.3 | 7.7 | 7.2 | 7.6 | 5.7 | 7.1 |
| Continuous | 86.2 | 86.0 | 83.6 | 82.9 | 80.3 | 83.5 | 83.7 |
| Exit* | 6.3 | 6.1 | 7.7 | 8.9 | 10.5 | 9.8 | 8.2 |
| due to firm death | 4.0 | 3.9 | 4.8 | 3.8 | 3.2 | 0.8 | 3.5 |
| due to other reason | 0.8 | 0.9 | 0.8 | 2.3 | 2.5 | 0.6 | 1.3 |
| reason unknown | 1.5 | 1.3 | 2.0 | 2.8 | 4.8 | 8.4 | 3.4 |
| Entry and exit in a single year | 0.6 | 0.6 | 1.1 | 1.0 | 1.5 | 0.9 | 1.0 |
| TOTAL | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

**: this excludes enterprises that exit in the year of entry*

*Source: Longitudinal Enterprise Database 1993-1999*

Our data shows that the formal registration of a firm exit (as registered in the business registration data) lags behind the economic exit of the firm. The size of this lag is approximately two years (see Table 8 in Annex I). Consequently, information on the reason for exit (whether a firm exits due to firm death or due to another reason) lags behind the actual exit[1]. This explains why the share of enterprises for which the reason for exit is unknown, increases from 1.5% for 1993 to 8.4% for 1998 (Table 1). Based on the available information, the main reason for enterprises to exit is due to firm death (economic activities no longer occur). Other reasons, however, also occur, in particular during 1996 and 1997.

### *Sector of industry*

The distribution of employer enterprises across the sectors is presented in Table 2 (averaged over the period 1993-1997). About 17% of the employer enterprises are active in retail trade, 14% in business activities and 11% in wholesale. Other relatively prevalent sectors are construction, hotels and restaurant and other business activities (10%).

[1] The reason for exit is registered when the formal exit of the enterprise takes place; this is the year in which the enterprise is removed from the general business register.

Table 2 Relative distribution of employer enterprises from the Dutch business economy by sector of industry, for 1997(%)

| *Sector* | *Relative distribution* |
|---|---|
| Manufacturing of food products; beverages and tobacco | 1.7% |
| Manufacturing of metals | 4.1% |
| Manufacturing of chemicals and chemical products | 0.6% |
| Manufacturing n.e.c. | 4.1% |
| Construction | 10.1% |
| Sale, maintenance and repair of motor vehicles | 4.7% |
| Wholesale | 11.2% |
| Retail trade | 17.1% |
| Hotels and restaurants | 9.9% |
| Transport and storage | 6.2% |
| Communication | 0.5% |
| Financial services | 5.9% |
| Business activities | 14.2% |
| Other business activities | 9.7% |
| Total | 100 |

*Note: The business economy excludes enterprises from the following sectors: 'Agriculture, forestry and fishing', 'Mining and quarrying', 'Electricity, gas and water supply', 'Real estate and renting', 'Health and social services', 'Public services', 'Private households with personnel', and 'Extra-territorial bodies and organizations'.*

*Source: Longitudinal Enterprise Database 1993-1999*

### *Firm size and employment growth*

The size of the workforce represents the annual number of labour years that was provided in a specific year. This represents the total number of paid working hours within an enterprise (excluding owners). This information is obtained annually in December, and is measured in full-time equivalents. It is based on all employees on the remuneration list, accounts for differences in the number of hours worked per week and the number of weeks worked per year, and includes paid time for holidays, sick leave, etc.

In line with the definition of fast-growing enterprises, we consider the average growth rate over a three-year period rather than the growth rate during the past year. The average three-year growth rate is calculated as $([size_t)/size_{t-3}]^{(1/3)} -1)$, for all enterprises with a positive size in year t and t-3. Because of the time lag involved, the average three-year growth rate cannot be calculated for the years 1993 – 1995.

### *Enterprise growth types: fast-growing and fast-shrinking enterprises*

From 1996 onwards, it is possible to determine for each enterprise whether it can be considered as a fast-growing enterprise. Based on the OECD definition, fast-growing enterprises are defined as enterprises with an average three-year growth rate greater than 0.2 (20%), employing more than 10 employees three

years ago, without any mergers, take-overs or other mutations during the past three years. By way of comparison, various other enterprise growth types can also be distinguished:

- Fast-shrinking enterprises can be defined as enterprises with an average three-year growth rate smaller than -0.2 (-20%) that employed more than 10 employees three years ago and were not involved in mergers, take-overs or other mutations.
- Fast-growing micro enterprises and fast-shrinking micro enterprises are defined likewise, for enterprises employing no more than 10 employees three years ago.
- Other mutations: enterprises involved in mergers, take-overs or other mutations during the past three years that were not associated with firm entry or firm exit.
- Stable enterprises: this refers to all enterprises not classified otherwise, and includes enterprises of all size classes not included in mergers, take-overs or other mutations, with an average three-year growth rate varying between -0.2 and +0.2.

According to our database, between 1996 and 1998 the number of fast-growing enterprises in the Dutch business economy increased from about 1,200 to 1,600, while the number of fast-shrinking enterprises decreased from more than 2,000 to less than 1,000. The same developments also occurred for the micro enterprises (Table 3).

Table 3 Enterprise growth types, for the Dutch business economy, for 1996-1998 (x 1,000 enterprises)

| *Enterprise growth type* | *1996* | *1997* | *1998* |
|---|---|---|---|
| Stable enterprises | 144.5 | 126.5 | 129.7 |
| Fast-growing enterprises | 1.2 | 1.3 | 1.6 |
| Fast-growing micro enterprises | 23.5 | 23.5 | 24.5 |
| Fast-shrinking enterprises | 2.1 | 1.3 | 1.0 |
| Fast-shrinking micro enterprises | 17.3 | 13.2 | 11.7 |
| Other mutations | 2.9 | 28.2 | 28.8 |
| Enterprises younger than three years | 49.2 | 53.8 | 50.4 |
| Growth rate undetermined | 32.7 | 28.0 | 24.2 |
| TOTAL | 273.3 | 275.9 | 272.0 |

*Source: Longitudinal Enterprise Database 1993-1999*

## 3.3 Estimation methodology

*Regression model: multinomial logit*

The dependent variable of this study is the survival status of enterprises. For enterprises that exist at the beginning of year *t*, this variable can take three values: the value 1 if firm *i* exited in year *t* due to firm death, 2 if firm *i* exited in

year *t* due to a reason other than firm death (e.g. merger, break-up, restructuring), and 0 if the enterprise still exists at the end of year *t*. [1]

Multinomial logit regressions are used to determine how (and to what extent) the probability of exit due to firm death in a certain year is related to the employment growth rates in the recent past. Because firm exits due to other reasons are treated differently from the reference group of continuous enterprises, multinomial logit models allow us to identify the effect of employment growth rates on firm exit due to firm death[2]. The dependent variable is then linked to several explanatory variables.

*Exit in year t is related to lagged growth rates*

The main explanatory variable concerns the employment growth in the recent past. We use the average three-year growth rate as independent variable in the analyses and determine its effect on exit rates. According to our hypothesis, the relationship between the average three-year growth rate and firm survival during year t can be characterised by a U-shaped relationship. This hypothesis will be tested by including a quadratic function of the average three-year growth rate. In addition, we will also estimate a model with a cubic function. The cubic term may help to avoid any potential disturbing influence of outliers on the parameter estimates of a second order polynomial relation between firm growth and exit. If the cubic term is significant, we will present the results of the cubic function, but focus on the interpretation of the linear and quadratic term. No theoretical interpretation will be sought for the cubic term.

The survival status of the enterprise in year t has to be related to the lagged average three-year growth rate (i.e. the average three-year growth rate for the years t-4 to t-1). The reason to include the lag is related to the measurement of firm size. Recall that firm size represents the total number of paid working hours within an enterprise. Suppose that an enterprise exits in august in year t. In that case, the registered enterprise size for year t is based on the employment during the first half of that year. For the calculation of the average three-year growth rate, this measure of enterprise size (based on 6 months of employment) is then compared to the enterprise size three years earlier (based on 12 months of employment). This results in a biased measure of the average three-year growth rate, where the size of the bias depends on the month in which the firm actually exited[3].

[1] For firms that enter in year *t,* the survival status is not defined.

[2] Otherwise, the reference group would also include firm exits which might cloud the estimation results. Similarly, excluding firm exits due to other reasons from the sample might lead to biased results.

[3] In addition, there is also a theoretical argument to include a lag: for fast-growing firms that exit the market because they cannot adjust their managerial style quickly enough, it is conceivable that their growth rates stagnate in the final year before they actually exit (during their final attempt to continue the enterprise they may not continue their growth rate). Thus, they may not be classified as a fast-growing enterprise anymore in their final year of existence, even if they exit on December 31 of that year.

*Control variables: size, sector and age*

The number of control variables in our dataset is very limited; we can only control for size, sector and age.

In the regression models we include the log of firm size, four years lagged. To account for the firm's sector of industry, we include dummy variables in the model covering the 14 sectors that are part of the business economy. Regarding firm age, we do not want to impose a restriction on the functional form of the relationship between age and exit due to firm death. Instead of including (for example) firm age and firm age squared, we use dummy variables to distinguish between firms that are four years old, five years old, and so forth until nine years old, 10 to 14 years old, 15 to 24 years old, and firms that are 25 years or older. The oldest age category is used as reference category.

*Model estimations only for 1997*

The regression model imposes several restrictions on the available data. First, the model requires information on employment growth in the recent past. The average three-year growth rate can only be calculated for the years 1996 to 1999. Because the model includes the lagged average three-year growth rate, the model cannot be estimated for years prior to 1997. In addition, enterprises that do not (yet) exist for at least three years are excluded from the sample, such as new entries and enterprises that entered and exited in a single year.

Furthermore, the model requires information on the year of exit and the reason for this exit. This implies that the model cannot be estimated for 1999 (economic exit cannot be determined for this year) or for 1998 (for the large majority of enterprises that exit in this year, the reason for exit is unknown; see Table 1). As a result, the model can only be estimated for 1997.

# 4 Results

In the first section of this chapter, we discuss how many employer enterprises in the market sector actually exited the market (due to firm death) in 1997. Exit rates are shown by sector and by size class.

In the next section, we examine to which extent employment growth rates in the recent past can affect the probability of exit. This section presents the regression results of multinomial logit models that relate firm exit due to firm death to lagged employment growth. These regressions are based on a sample of enterprises that existed for at least four years at the beginning of 1997.

## 4.1 Firm death across sectors and size-classes

Exit rates due to firm death are on average highest in communication and lowest in construction (Table 4). As the exit rate in construction is the overall lowest, this sector is marked as reference sector in the regression models.

Table 4 The share of employer enterprises existing at the beginning of 1997 that exited in 1997 due to firm death, by sector (%)

| *Sector* | *Exit rate* |
|---|---|
| Manufacturing of food products; beverages and tobacco | 4.0% |
| Manufacturing of metals | 1.9% |
| Manufacturing of chemicals and chemical products | 3.0% |
| Manufacturing n.e.c. | 2.9% |
| Construction | 1.5% |
| Sale, maintenance and repair of motor vehicles | 1.6% |
| Wholesale | 2.9% |
| Retail trade | 2.6% |
| Hotels and restaurants | 3.0% |
| Transport and storage | 4.2% |
| Communication | 6.8% |
| Financial services | 4.1% |
| Business activities | 3.0% |
| Other business activities | 1.6% |
| Total | 2.7% |

*Source: Longitudinal Enterprise Database 1993-1999*

Exit rates decrease with firm size, from 2.9% for micro firms to 0.4% for large firms (Table 5). The exit rates presented in this section are considerably smaller than the exit rates presented in Table 1. This is because the exit rates presented in this section only refer to the population of employer enterprises that started in 1993 or earlier. This excludes the youngest firms, which are known to have the highest exit rates.

Table 5 The share of employer enterprises existing at the beginning of 1997 that exited in 1997 due to firm death, by size-class (%)

| *Size-class* | *Exit rate* |
|---|---|
| Micro (1 – 9 fte) | 2.9% |
| Small (10 – 49 fte) | 1.1% |
| Medium-sized (50 – 249) | 0.6% |
| Large (>= 250) | 0.4% |
| Total | 2.7% |

*Source: Longitudinal Enterprise Database 1993-1999*

## 4.2 Firm death and employment growth rates

The model is estimated separately for firms employing no more than 10 employees in 1993[1] and for firms employing more than 10 employees in 1993. The results are presented in Table 6. We have estimated a quadratic and cubic function of the relationship with the lagged average three-year growth rate. For the micro enterprises, the cubic term was significant, so we present the results of the cubic function. For the larger enterprises, the cubic term was not significant, so we present the results of the quadratic function.

For both size classes, the parameter estimates for the employment growth rates support the hypothesis of an inverted U-shaped relation between firm growth prior to year t and firm survival during year t: the likelihood that an enterprise will exit due to firm death initially decreases with employment growth, until a certain level of employment growth. From that level onwards, the probability of exit due to firm death starts to increase (although for the micro firms this effect flattens from a certain level of employment growth onwards).

### *Control variables*

The log of firm size four years ago has a negatively effect on the probability of exit due to firm death. This suggests that larger enterprises have a smaller probability of exit due to firm death in the coming three years than smaller enterprises, other things being equal, which is in line with the stylised facts discussed in chapter 2. This is true for the micro firms as well as for the larger firms.

[1] This year marks the beginning of the three-year period for which the average three-year growth rate is determined.

Table 6 Parameter estimates of a multinomial logit model explaining firm exit due to firm death in 1997, for two different size classes

| | | | | |
|---|---|---|---|---|
| Dependent variable | | | | |
| Category 0 | : Continuous enterprises (base outcome) | | | |
| Category 1 | : Exit due to firm death | | | |
| Category 2 | : Exit due to other reason (parameter estimates not reported) | | | |
| Method | : Maximum Likelihood | | | |
| | Enterprises employing no more than 10 employees in 1993 | | Enterprises employing more than 10 employees in 1993 | |
| | Coefficient | P-value | Coefficient | P-value |
| Intercept | -3.66 | 0.00 | -3.80 | 0.00 |
| Average three-year growth rate (lagged) | -1.36 | 0.00 | -2.82 | 0.00 |
| Average three-year growth rate (lagged), squared | 2.20 | 0.00 | 1.40 | 0.00 |
| Average three-year growth rate (lagged), third power | -0.95 | 0.00 | - | - |
| Controls | | | | |
| Log(firm size), 4 years lagged | -0.47 | 0.00 | -0.35 | 0.00 |
| Firm age | | | | |
| 4 years | 0.46 | 0.00 | 0.67 | 0.08 |
| 5 years | 0.46 | 0.00 | 0.94 | 0.00 |
| 6 years | 0.41 | 0.00 | 0.63 | 0.03 |
| 7 years | 0.12 | 0.19 | 0.67 | 0.01 |
| 8 years | -0.07 | 0.50 | 0.21 | 0.55 |
| 9 years | -0.04 | 0.68 | 0.30 | 0.38 |
| 10-14 years | -0.15 | 0.02 | 0.42 | 0.01 |
| 15-24 years | -0.12 | 0.02 | -0.20 | 0.17 |
| ≥ 25 years (base category) | | | | |
| Sector of industry | | | | |
| Manufacturing of food products, beverages and tobacco | 1.28 | 0.00 | 0.73 | 0.01 |
| Manufacturing of metals | 0.26 | 0.06 | 0.53 | 0.01 |
| Manufacturing of chemicals and chemical products | 1.08 | 0.00 | 0.83 | 0.02 |
| Manufacturing n.e.c. | 0.69 | 0.00 | 0.72 | 0.00 |
| Construction (base category) | | | | |
| Sale, maintenance and repair of motor vehicles | 0.06 | 0.62 | -0.22 | 0.49 |
| Wholesale | 0.54 | 0.00 | -0.01 | 0.95 |
| Retail trade | 0.48 | 0.00 | -0.02 | 0.93 |
| Hotels and restaurants | 0.59 | 0.00 | -0.27 | 0.41 |
| Transport and storage | 1.02 | 0.00 | -0.06 | 0.80 |
| Communication | 1.46 | 0.00 | -27.60 | 0.00 |
| Financial services | 0.82 | 0.00 | 0.66 | 0.05 |
| Business activities | 0.52 | 0.00 | 0.15 | 0.48 |
| Other business activities | -0.24 | 0.02 | -0.01 | 0.98 |

*Note: Parameter estimates of category 2 (firm exit due to other reason) are not reported; Number of observations: 169,118; Number of exits due to firm death in 1997: 3,524; Number of fast-growing enterprises (lagged): 1,084.*

*Source: Longitudinal Enterprise Database 1993-1999*

As far as the enterprise's age is concerned, the results suggest an S-shaped relationship between firm age and death rate. For micro firms, the probability of ex-

iting due to firm death decreases with firm age, between the ages of 4 to 24 years. After that, the probability of exiting due to firm death increases somewhat with firm age. For larger firms, the pattern is more erratic.

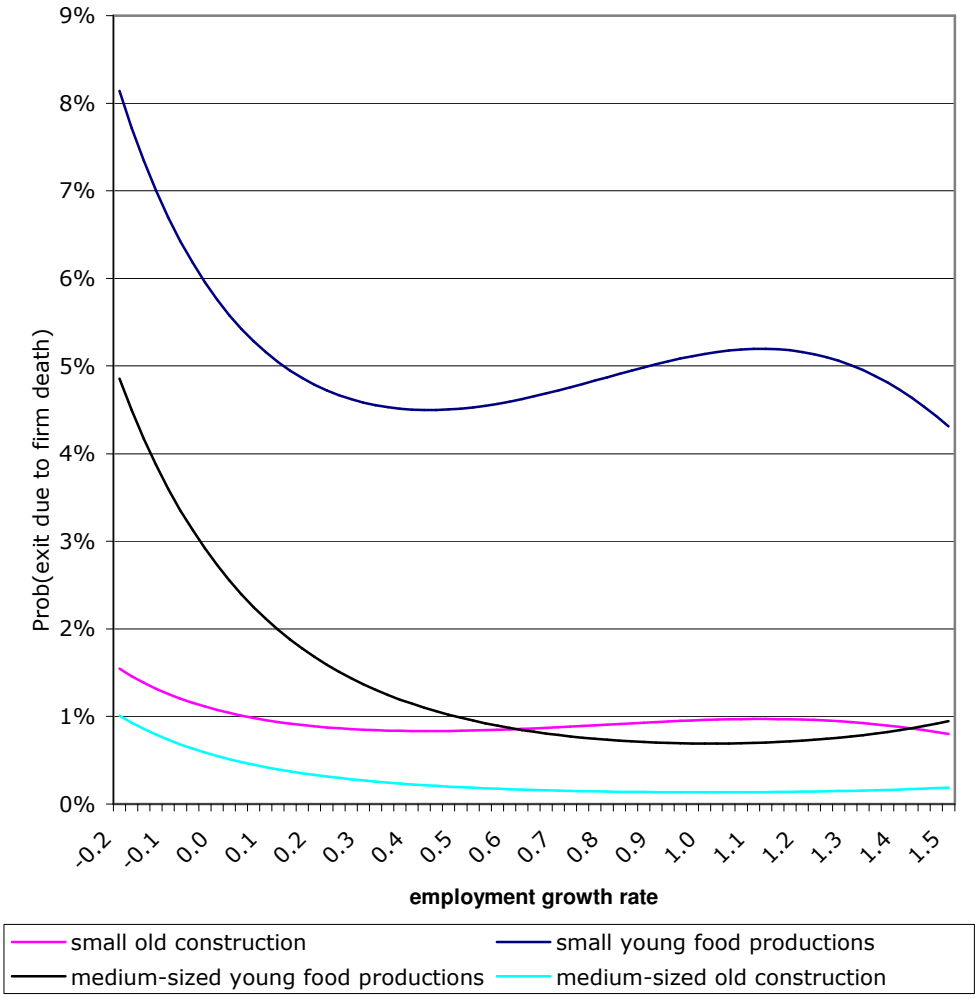
*Interpretation of the results*

For a better interpretation of the results, we show how the probability of exit due to firm death varies with the average three-year employment growth rate, for four different firms. Figure 1 is based on the outcomes of the regression analysis and shows the estimated relationship for two micro firms (employing 5 employees 4 years ago) and two medium-sized firms (employing 50 employees 4 years ago). For both sizes, we include the results for a 5-year old firm from the manufacturing of foods industry and a 25-year old firm from the construction industry[1]. The results show that for a considerable range, the relationship between firm growth and firm exit is negative. For micro firms, the direction of the relationship changes for an average three-year employment growth rate of 0.5 or 50%. This represents a firm that grows from 5 to 17 employees in three years. For larger firms, the average three-year employment growth rate becomes about 1 or 100% before the direction of the relationship changes, representing a firm that grows from 50 to 400 employees in three years.

Only a small minority of all enterprises reach average three-year employment growth rates of 100% or more. This suggests that for the large majority of enterprises, the relationship between firm growth and firm survival can be better described by a positive relationship rather than an inverted U-shaped relationship. We hesitate, however, to draw this conclusion, because it depends strongly on the chosen functional form and the values of the parameter estimates. Different functional forms need to be tested before clear conclusions can be reached.

[1] The estimation results indicate that these groups have the highest and lowest exit rates.

Figure 1 Probability of exit due to firm death, for employer enterprises of the Dutch business economy in 1997, for different enterprise characteristics




*Note: "micro" refers to enterprises with size=5 in 1993; "medium-sized" refers to enterprises with size=50 in 1993; "young" enterprises were 5 years old in 1997; "old" enterprises were 25 years old in 1997.*

*Source: Own calculations, based on the outcomes of multinomial logit regressions presented elsewhere in this paper*

# 5 Conclusions

*Summary and main findings*

This paper examines the relationship between firm growth and firm survival. From a business point of view, fast employment growth is generally related to high sales revenue. From a macro-economic perspective, fast growing firms are considered as central drivers of job creation. Growing fast may, however, also be disadvantageous in the sense that firms may not be able to respond immediately to high employment growth in terms of making necessary changes to their organization and management structure. This may put the firm in the risk of exiting due to firm death. Both from a theoretical and a policy perspective it is interesting to investigate the impact of a recent period of fast employment growth on the survival of the firm. The aim of this study is therefore to explore whether high employment growth rates in the recent past have a negative effect on firm survival.

Based on literature on stage models and models on noisy selection, we have formulated the hypothesis that the relationship between firm growth prior to year t and firm survival during year t can be characterised by an inverted U-shaped relation. To test this hypothesis, we made use of the *Longitudinal Enterprise Database 1993-1999*, which is constructed from business registration data from the Chambers of Commerce, and employment data from the State Unemployment Insurance Agency, Production Statistics and the Survey on Employment and Wages of Statistics Netherlands. For each enterprise and each individual year, the dataset provides the year of entry, the year of exit – in case of a firm exit – and the main reason for exit (in particular, whether exit is due to actual firm death or because of other reasons including mergers, take-overs and administrative reasons), the sector of industry in which the firm is active, the age of the firm and the size of the workforce.

To investigate the hypothesis, we estimated multinomial logit models for 1997. These models allow us to distinguish firms that exit due to firm death from firms that exit for reasons other than firm death (including mergers, take-overs and administrative reasons). Both types of exits are compared to the reference group of enterprises that stay in business. Employment growth is measured as the average annual employment growth over the past three years.

The estimation results confirm that the relationship between firm growth and firm survival can be described by an inverted U-shaped relation. An enterprise's exit rate initially decreases with the lagged average three-year growth rate, until a certain level of employment growth is reached. From that level onwards, the probability of exit due to firm death starts to increase, although this effect flattens from a certain level of employment growth onwards.

At the same time, the results indicate that the top of the inverted U-shaped relation occurs at an average three-year growth rate of 50% for micro firms and 100% for larger firms. Only a small share of all enterprises reaches such high average three-year employment growth rates. This suggests that for the large majority of enterprises, the relationship between firm growth and firm survival can be better described by a positive relationship rather than an inverted U-

shaped relationship. These results depend strongly on the chosen functional form and the values of the parameter estimates. Therefore, before any final conclusions concerning the nature of this relationship can be drawn, different functional forms need to be tested. Nevertheless, there are as yet no signs that policies that aim to increase the number of fast-growing firms may result in an increase of the rate of firm deaths.

### *Suggestions for future research*

This study should be seen as a first exploration of the relationship between enterprise growth and enterprise survival. Further research is required to dive deeper into this relationship and explore the size of the impact of employment growth on the probability to exit due to firm death.

The models presented here can be elaborated in various ways. First of all, different functional forms of the relationship between firm growth and firm survival should be tested. Other functional forms that can be used include the log of the lagged average three-year growth rate[1] and a non-parametrical relationship (using dummies to indicate different growth rate categories). A second option is to estimate the model for separate sectors of industry. Also, a different measure for employment growth could be used. Since policy makers have a specific interest for the group of fast-growing enterprises, the current model could be estimated with dummies indicating fast-growing enterprises (instead of employment growth during the past three years). Yet another option is to estimate duration models rather than multinomial logit models. Finally, since this study explores the relationship between firm growth and firm survival based on data for a single year (1997) in a single country (The Netherlands), future research may also pay attention to this relationship in other countries or in more recent years.

[1] A negative parameter for the log would result in a so-called 'hockey stick' relationship.

# References


Acs, Z.J., W. Parsons and S. Tracy (2008), High Impact Firms: Gazelles Revisited, *Office of Advocacy Working Paper 328*, U.S. Small Business Administration.

Agarwal, R. and D.B. Audretsch (2001), Does Entry Size Matter?, *Journal of Industrial Economics* 49(1), 21-43.

Ahmad, N. (2006), A Proposed Framework For business Demography Statistics, *OECD Statistics Working Papers 2006/03*, OECD Publishing

Almus, M. and E. Nerlinger (2000), Testing 'Gibrat's law' for young firms-empirical results for West Germany, *Small Business Economics* 15, 1-12.

Audretsch, D.B. and T. Mahmood (1994), Firm selection and industry evolution: The post-entry performance of new firms, *Journal of Evolutionary Economics* 4, 243-260.

Audretsch, D M. and T. Mahmood (1995), New Firm Survival: New Results Using a Hazard Function, *Review of Economics & Statistics*, 77(1), 97-103.

Audretsch, D.B., L. Klomp, E. Santarelli and A.R. Thurik (2004), Gibrat's Law: Are the Services Different?, *Review of Industrial Organization* 22(3), 301-324.

Becchetti, L. and G. Trovato (2002), The Determinants of Growth for Small and Medium Sized Firms: The Role of the Availability of External Finance, *Small Business Economics* 19(4), 291-306.

Begley, T.M. and D.P. Boyd (1987), A comparison of entrepreneurs and managers of small business firms, *Journal of Management* 13, 99-108.

Bigsten, A. and M. Gebreeyesus (2007), The small, the young, and the productive: Determinants of manufacturing firm growth in Ethiopia, *Economic Development and Cultural Change* 55(4), 813-840.

Birch, D., A. Haggerty and W. Parsons (1995), *Who's Creating Jobs?*, Boston, Cognetics Inc.

Bottazzi, G. and A. Secchi (2003), Common properties and sectoral specificities in the dynamics of US manufacturing companies, *Review of Industrial Organization* 23, 217-232.

Calvo, J.L. (2006), Testing Gibrat's law for small, young and innovating firm, *Small Business Economics* 26, 117-123.

Carree, M.A. and L. Klomp (1996), Small Business and Job Creation: A Comment, *Small Business Economics* 8, 317-322

Coad, A. and W. Hölzl (2010), Firm growth: empirical analysis, *Papers on Economics and Evolution* 2010-02, Max Planck Institute of Economics, Evolutionary Economics Group

Davidsson, P., L. Achtenhagen and L. Naldi (2005), Research on Small Firm Growth: A Review, *Proceedings of the European Institute of Small Business,* 1-28

Doi, N. (1999), The Determinants of Firm Exit in Japanese Manufacturing Industries, *Small Business Economics* 13(4), 331-337.

Donselaar, P., H. Erken en J. van den Heuvel (2007), Determinanten van kernindicatoren op de terreinen innovatie en ondernemerschap: Kwantificeringen op basis van empirisch onderzoek, in relatie tot beleidsambities, Den Haag: Ministerie van Economische Zaken.

Dunne, P. and A. Hughes (1994), Age, size, growth and survival: UK companies in the 1980s, *Journal of Industrial Economics* 42(2), 115-140.

Dunne, T., M. J. Roberts and L. Samuelson (1989), The Growth and Failure of U.S. Manufacturing Plants, *The Quarterly Journal of Economics* 104, 671-698.

Pakes, A. and R. Ericson (1998), Empirical Implications of Alternative Models of Firm Dynamics, *Journal of Economic Theory* 79(1), 1-46.
Geroski, P.A. (1995), *Market Structure, Corporate Performance, and Innovative Activity*, Oxford University Press
Geroski, P. A. and K. Gugler (2004), Corporate growth convergence in Europe, *Oxford Economics Papers* 56, 597-620.
Goddard, J., J. Wilson and P. Blandon (2002), Panel tests of Gibrat's law for Japanese manufacturing, *International Journal of Industrial Organization* 20(3), 415-433.
Greiner, L.E. (1972), Evolution and revolution as organizations grow, *Harvard Business Review* 50(4).
Jovanovic, B. (1982), Selection and the evolution of industry. *Econometrica* 50(3), 649-670.
Haveman H.A. (1995), The Demographic Metabolism of Organizations: Industry Dynamics, Turnover, and Tenure Distributions, *Administrative Science Quarterly* 40, 586-618.
Henreksen, M. and D. Johansson (2008), Gazelles as Job Creators - A Survey and Interpretation of the Evidence, IFN Working Paper, 733.
Liu, J., M. Tsou and J. Hammitt (1999), Do small plants grow faster? Evidence from the Taiwan electronics industry, *Economics Letters* 65(1), 121-129.
Mata, J. and P. Portugal (1994), Life Duration of New Firms, *Journal of Industrial Economics* 42, 227-246.
McDougall, P.P., R.B. Robinson and A.S. DeNisi (1992), Modeling new venture performance: An analysis of new venture strategy, industry structure, and venture origin, *Journal of Business Venturing* 7, 267-289.
McPherson, M.A. (1996), Growth of micro and small enterprise in Southern Africa, *Journal of Development Economics* 48, 253-277.
Mitchell, W. (1994), The Dynamics of Evolving Markets: The Effects of Business Sales and Age on Dissolutions and Divestures, *Administrative Science Quarterly* 38, 575-602.
OECD (2007), Eurostat-OECD Manual on Business Demography Statistics, OECD Publications No. 56029 2008, Paris: OECD
Reichstein, T. and M. Dahl (2004), Are firm growth rates random? Analysing patterns and dependencies, *International Review of Applied Economics* 18(2), 225-246.
Robson, P. and R. Bennett (2000), SME growth: The relationship with business advice and external collaboration, *Small Business Economics* 15(3), 193-208.
Schumpeter, J.A. (1934), *The Theory of Economic Development*, Cambridge, MA: Harvard University Press.
Sharma, A. and I. Kesner (1996), Diversifying Entry: Some Ex Ante Explanations for Post-Entry Survival and Growth, *Academy of Management Journal* 39, 635-677.
Snel, D., K. Bakker, W.H.J. Verhoeven, R. in 't Hout and N.G.L. Timmermans (2010), Internationale benchmark ondernemerschap 2010: Benchmark ondernemerschap, bedrijvendynamiek en snelle groeiers (in Dutch), EIM Report A201006, Zoetermeer: EIM.
Sutton, J. (1997), Gibrat's legacy, *Journal of Economic Literature* 35, 40-59.
Van Maarseveen (2002), *Algemene tellingen in de twintigste eeuw: de methode van onderzoek bij personen en bedrijven* (in Dutch), Voorburg: CBS.
Yasuda, T. (2005), Firm growth, size, age and behaviour in Japanese manufacturing, *Small Business Economics* 24(1), 1-15.

# ANNEX I Longitudinal Enterprise Database 1993-1999

The *Longitudinal Enterprise Database 1993-1999* includes annual employment information on almost all employer enterprises of the Dutch business economy between 1993 and 1999[1]. It is based on various sources of administrative information. This annex discusses the various data sources of the longitudinal enterprise database and the determination and distribution of firm age. It ends with a brief discussion of the quality and limitations.

## Data sources

For the construction of the *Longitudinal Enterprise Database 1993-1999* we have combined various existing registrations regarding the enterprise population in The Netherlands. The main sources are business registration data from the Chambers of Commerce and the Employment Database 1993–1999. The Employment Database 1993 – 1999 combines employment data from the State Unemployment Insurance Agency, Production Statistics and the Survey on Employment and Wages of Statistics Netherlands. These datasets are discussed below.

### *Business registration data*

The main data source is the Business Registration Data from the Dutch Chambers of Commerce (in Dutch: Algemeen Bedrijven Register, abbreviated as ABR). ABR is the main business registration system in the Netherlands. All enterprises have to register their enterprise with the Chambers of Commerce. They also have to provide information on when they became active and whether certain mutations took place (e.g. merger, take-over etc). If the enterprise ceases to exist, this also has to be registered, including the main reason why.

The unit of registration at the Chamber of Commerce is the legal unit. This often coincides with an enterprise, but this is not always the case. Certain enterprises may consist of several legal units. The ABR presents information on enterprises based on the underlying information of legal units. In case an enterprise consists of several units, the data from the main unit is used for the enterprise.

The following information is available from the ABR for each individual year:
- Enterprise (unit) identification number.
- Year of entry.
- Mutations that took place. These include firm birth, other types of firm entries, mergers, take-overs, firm death, other types of firm exit, and other administrative mutations.
- Year of exit (registered only if a firm exits).

An overview of mutations that took place between 1994 and 1999 is presented in Table 7. According to this overview, the distribution of the registered mutations

[1] The business economy excludes the following sectors of industry: 'Agriculture, forestry and fishing', 'Mining and quarrying', 'Electricity, gas and water supply', 'Real estate and renting', 'Health and social services', 'Public services', 'Private households with personnel', and 'Extra-territorial bodies and organizations'.

is fairly stable across time, except for 1997. The number of other mutations that is registered in that year is considerable more than in all other years. This is mainly caused by an increased number of administrative mergers. It is not clear whether this is the result of actual activities in the enterprise population or whether this is the result of changes in the ABR itself.

Table 7 Overview of occurring mutations, for all enterprises that reported economic activity in at least one year between 1993-1999 (%)

| *Mutations* | *1994* | *1995* | *1996* | *1997* | *1998* | *1999* |
|---|---|---|---|---|---|---|
| No mutation | 94.3 | 91.3 | 90.7 | 80.4 | 91.2 | 91.3 |
| Entry due to firm birth | 4.8 | 5.0 | 5.0 | 4.7 | 3.5 | 3.1 |
| Exit due to firm death | 0.5 | 2.5 | 3.1 | 4.1 | 3.0 | 3.3 |
| Entry due to other reason (including administrative entry and re-entry) | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 |
| Exit due to other reason | 0.1 | 0.6 | 0.6 | 2.7 | 1.6 | 0.8 |
| Other mutations | 0.2 | 0.4 | 0.4 | 7.9 | 0.4 | 1.2 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

*Note: For each year, the category "no mutations" not only includes existing enterprises without mutations, but also enterprises that did not yet (or not anymore) exist in that specific year (for example, a firm that entered in 1997 is classified as entry in 1997 and as 'no mutation' in all other years).*

*Source: Own calculations of EIM based on the Business Registration Data (ABR) 1994 – 1999 available at Statistics Netherlands.*

### *Employment database 1993-1999*

#### *Main data source: State Unemployment Insurance Agency*

The main data source for the employment database is the State Unemployment Insurance Agency (in Dutch: Uitvoeringsinstituut Werknemersverzekeringen, abbreviated as UWV). This data source provides the annual number of labour years for each individual enterprise that employed at least one employee[1].

The number of labour years represents the total number of paid working hours within an enterprise (excluding owners). This information is obtained annually in December, and is measured in full-time equivalents. It is based on all employees on the remuneration list, accounts for differences in the number of hours worked per week and the number of weeks worked per year, and includes paid time for holidays, sick leave, etc.

#### *Additional data sources employment levels*

In theory, all Dutch enterprises with paid employees should be represented in the UWV dataset. However, information about large enterprises in particular tends to be lacking. To overcome this problem we used information from two ad-

[1] The ABR also contains information concerning the number of employees, but this information is less precise and less accurate than the information available from UWV.

ditional data sources. First of all, we used information from various Production Statistics for the years 1993-1999. Production Statistics cover a substantial part of the business economy, and are based (among other things) on a complete coverage of all large enterprises in the relevant sectors.

Since the Production Statistics do not cover all sub-sectors of the business economy, we have used the Survey Employment and Wages (in Dutch: Enquête Werkgelegenheid en Lonen, abbreviated as EWL) to obtain information for the missing sub-sectors. This information was available for the years 1994 to 1999.

*Linking different employment measurements*

The main difference between the various data sources on employment levels is the nature of the employment information. Whereas the data from the State Unemployment Insurance Agency presents the amount of labour years per enterprise, this information is not available from the additional data sources. When information was available from these additional data sources only, we had to estimate the amount of labour years based on the available information.

The various Production Statistics contain information about the number of people that are working in the enterprises (at the end of September of each year). Many enterprises are present in this data source as well as in the data from the State Unemployment Insurance Agency. This makes it possible to determine the ratio between the amount of labour years and the number of working persons. This ratio varies considerably between sub-sectors and size classes (but not over time). We therefore determined sector and size class specific ratios. For those enterprises for which only information about the number of working people was available, these ratios were used to estimate the amount of labour years.

The Survey Employment and Wages includes yet another employment measurement: the number of full-time equivalents for each enterprise, measured at a specific point in time. Again, many enterprises are present in this data source as well as in the data from the State Unemployment Insurance Agency. This made it possible to determine the ratio between the amount of labour years and the number of full-time equivalents. This ratio varied only slightly between size classes, and proved to be independent of sub-sector and year. We therefore determined two ratios, one for small enterprises (with up to 5 full-time equivalents employed) and one for larger enterprises.

*Combining business registration data with the employment database*

The business registration data from the Chambers of Commerce (ABR) and the Employment Database 1993–1999 both contain the same unique enterprise (unit) identification number. This makes it possible to combine the two data sources with each other.

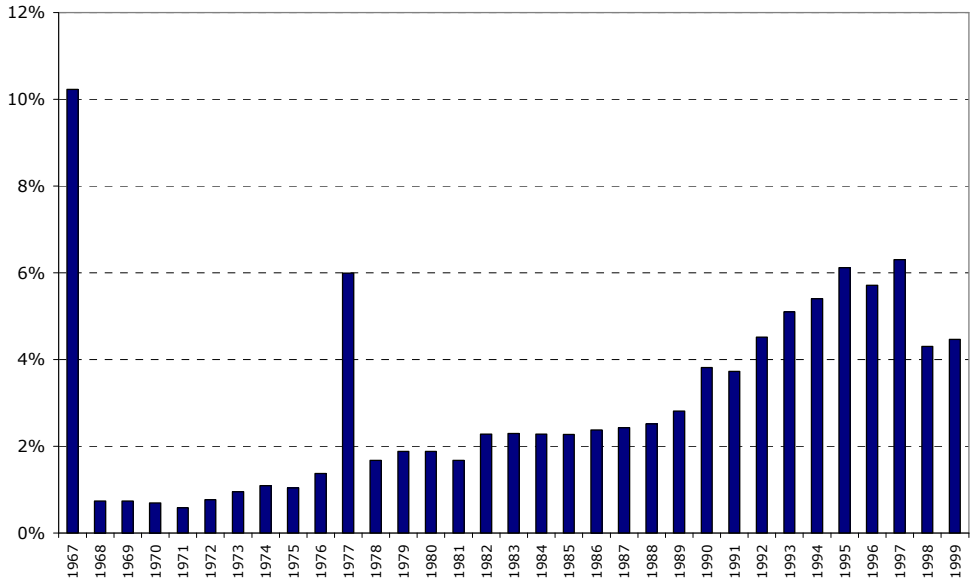
The Employment Database 1993–1999 is restricted to enterprises from the business economy with employees. The ABR also includes enterprises without employees, public enterprises and other organisations. The ABR therefore includes considerably more enterprises than the Employment Database 1993-1999.

## Statistics on firm age

*Determining age of enterprise*

The *Longitudinal Enterprise Database 1993-1999* is constructed by combining information from the ABR with the Employment Database 1993–1999. Both datasets contain information regarding the year of entry and exit. Regarding entry, information from ABR is most complete (from the Employment Database we only know the year of entry if entry took place between 1994-1999). Unfortunately, in ABR the year of entry is truncated to 1967, the year in which the ABR started. Start-up years prior to 1967 are not registered and set equal to the year in which the ABR officially started. This can be seen from Figure 2 which illustrates the year of entry for all enterprises that reported economic activity in at least one year in the period 1993-1999. This shows a peak in the year 1967 corresponding to the start of the business registration data.

Figure 2 Year of entry, for all enterprises that reported economic activity in at least one year in the period 1993-1999 (%)




*Source: Longitudinal Enterprise Database 1993-1999*

A second peak appears in 1977. This is probably related to the enterprise census that took place in that year[1]. Of the enterprises included in our sample, the largest share of entries can be observed in 1997 (6%).

[1] In the previous century, four different enterprise censuses (bedrijfstellingen) have been conducted in the Netherlands, three of which took place in 1930, 1950 and 1963. The fourth enterprise census took place in 1978. This is the last time that a complete enterprise census was held in the Netherlands. The ABR was used as the sample framework for this enterprise census. The outcomes of this enterprise census may very well have led to various corrections to the ABR. (Van Maarseveen, 2002).

Regarding exit, both ABR and the Employment Database provide valuable information. The ABR provides information regarding the reason for exit, while the Employment Database provides information regarding the final year in which economic activity was registered[1]. The ABR also contains information on the year of exit, but the year of exit from the ABR (i.e. the administrative exit) tends to lag behind the exit year from the Employment Database (this is defined as the final year in which an enterprise had paid employees; i.e. the economic exit), with a lag of two years. For instance, for the majority of enterprises for which the economic activities ceased in 1994 (economic exit), the administrative exit was registered in 1996 (see Table 8).

Table 8 Exit due to firm death: economic exit (exit according to Employment Database data) versus administrative exit (exit according to the ABR), for employer enterprises from the Dutch business economy, 1993-1999

| | *Administrative exit* | | | | | |
|---|---|---|---|---|---|---|
| *Economic exit* | *1994* | *1995* | *1996* | *1997* | *1998* | *1999* |
| *1993* | 620 | 9,014 | 3,642 | 1,911 | 704 | 543 |
| *1994* | 1,891 | 2,680 | 7,057 | 3,181 | 823 | 592 |
| *1995* | 1 | 2,118 | 4,500 | 9,371 | 2,679 | 1,334 |
| *1996* | 1 | 1 | 1,224 | 4,063 | 7,324 | 3,206 |
| *1997* | 1 | 0 | 1 | 1,985 | 3,119 | 9,098 |
| *1998* | 0 | 0 | 0 | 2 | 911 | 2,876 |
| *Still economic active in 1999* | 0 | 0 | 0 | 0 | 0 | 917 |

*Source: Business Registration Data and Employment Database 1993-1999*

If information on entry and exit is available from both ABR and the Employment Database, the year of entry (exit) is defined as the minimum of the two years of entry (exit) from both sources. Except for seven cases, the minimum is always the same as the economic exit.

A crossing of the year of entry and exit for all enterprises that reported economic activity in at least one year in the period 1993-1999 is provided in Table 9. This table shows that a small share of enterprises both entered and exited in a single year.

[1] We assume that economic activities cease to exist once a firm that previously employed employees, no longer employs any employees. We cannot rule out that an enterprise continues its economic activities as an enterprise without employees, but we assume that this will apply to only a very small share of all enterprises that cease to employ employees.

Table 9 Entry and exit: year of entry versus year of exit, for all employer enterprises that reported economic activity in the period 1993-1999 (rounded)

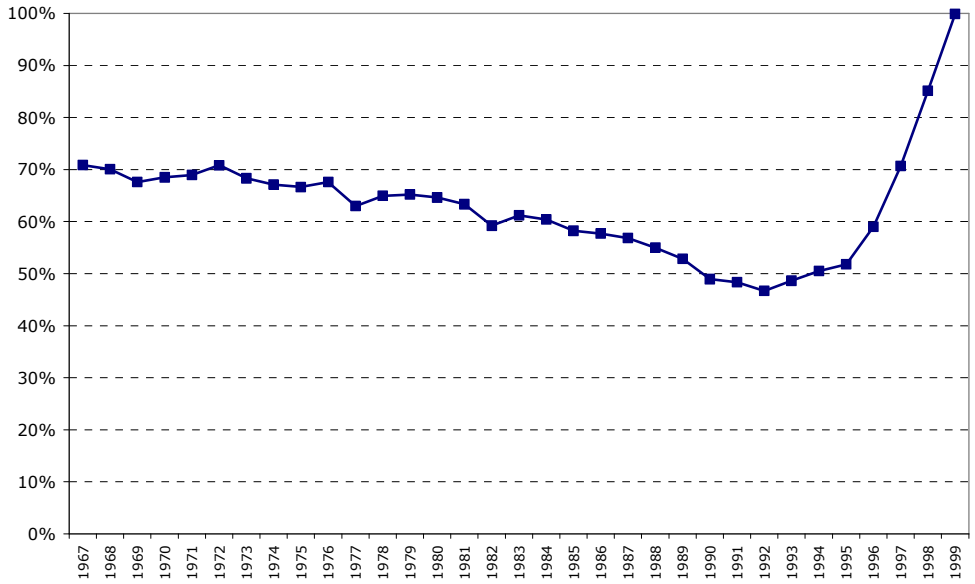
| Year of entry | *Economic active at the start of 1993* | *Year of exit* | | | | | | | *Still economic active at the end of 1999* |
|---|---|---|---|---|---|---|---|---|---|
| | | *1993* | *1994* | *1995* | *1996* | *1997* | *1998* | *1999* | |
| *1970 or earlier* | 55,500 | 2,900 | 2,400 | 2,500 | 2,800 | 2,900 | 2,800 | 100 | 39,100 |
| *1971-1975* | 19,900 | 1,000 | 800 | 900 | 1,100 | 1,200 | 1,200 | 0 | 13,500 |
| *1976-1980* | 57,300 | 3,100 | 2,800 | 3,300 | 3,700 | 3,800 | 3,600 | 100 | 36,900 |
| *1981-1985* | 48,400 | 3,500 | 2,700 | 3,200 | 3,300 | 3,500 | 3,000 | 100 | 29,200 |
| *1986-1990* | 62,500 | 5,200 | 4,800 | 5,100 | 4,800 | 4,900 | 3,900 | 100 | 33,500 |
| *1991* | 16,700 | 1,600 | 1,500 | 1,700 | 1,400 | 1,500 | 1,000 | 0 | 8,100 |
| *1992* | 20,200 | 1,800 | 2,000 | 2,200 | 1,800 | 1,800 | 1,200 | 0 | 9,400 |
| *1993* | 0 | 1,800 | 1,800 | 2,200 | 2,200 | 2,200 | 1,600 | 0 | 11,100 |
| *1994* | 0 | 0 | 1,800 | 2,900 | 2,700 | 2,700 | 1,800 | 0 | 12,200 |
| *1995* | 0 | 0 | 0 | 3,300 | 3,800 | 3,500 | 2,500 | 100 | 14,200 |
| *1996* | 0 | 0 | 0 | 0 | 3,200 | 4,600 | 2,600 | 100 | 15,100 |
| *1997* | 0 | 0 | 0 | 0 | 0 | 4,800 | 3,400 | 100 | 19,900 |
| *1998* | 0 | 0 | 0 | 0 | 0 | 0 | 2,700 | 200 | 16,400 |
| *1999* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20,000 |

*Source: Longitudinal Enterprise Database 1993-1999*

Figure 3 depicts the survival rate by year of entry of enterprises that are included in the longitudinal Enterprise Database 1993-1999 and still report economic activity in 1999. For instance, of all the employer enterprises that entered in 1967 and were still active in 1993, about 70% is still active in 1999. This survival rate gradually decreases until it reaches a minimum of less than 50% in 1992. This is the first year in which all entries are included in the sample[1]. From 1993 on, the survival rate gradually increases, reaching a share of close to 100% for firms that entered in 1999 (for firms that exit in 1999, information on the type of exit is hardly available).

[1] For example, firms that entered in 1992 and exited in that same year are not included in our sample.

Figure 3 Share of enterprises included in the Longitudinal Enterprise Database 1993-1999 that still reports economic activity in 1999, by year of entry




*Source: Longitudinal Enterprise Database 1993-1999*

## Quality and limitations of final dataset

### *Full coverage of the Dutch business economy for 1993-1998*

To determine the extent to which the final dataset covers the business economy, we have compared annual total employment of the enterprises in the Longitudinal Enterprise Database 1993-1999 with corresponding employment figures from Statistics Netherlands as published on Statline (the website of Statistics Netherlands). According to this comparison, our dataset includes 99% of total employment in the business economy for the years 1993-1998. The slight difference can be explained by differences in measurements (e.g. the conversion from number of employees to full-time equivalents). In 1999, this rate dropped to 93%. We suspect that a few large companies are no longer included in the Longitudinal Enterprise Database 1993-1999 for this year. Given these results, we conclude that our study offers an adequate coverage of the Dutch business economy for the years 1993-1998.

### *Limitations*

The information about the size of firms is based upon three different employment measurements. The conversion of the number of working people and the number of full-time equivalents into labour years is likely to increase the measurement error regarding firm size. Second, a common problem in this type of research is how to classify enterprises that change their main economic activity. We have not examined whether such changes may affect the relationship between firm growth and firm survival. Mainly for pragmatical reasons (but also because it does not occur that often), we assume that enterprises do not change between sectors of industry and use the economic activity that was registered first.

The results of EIM's Research Programme on SMEs and Entrepreneurship are published in the following series: Research Reports and Publieksrapportages. The most recent publications of both series may be downloaded at: www.entrepreneurship-sme.eu.

Recent Research Reports and Scales Papers

| | | |
|---|---|---|
| H201118 | 22-12-2011 | Beyond Size: Predicting engagement in environmental management practices of Dutch SMEs |
| H201117 | 22-12-2011 | A Policy Theory Evaluation of the Dutch SME and Entrepreneurship Policy Program between 1982 and 2003 |
| H201116 | 20-12-2011 | Entrepreneurial exits, ability and engagement across countries in different stages of development |
| H201115 | 20-12-2011 | Innovation barriers for small biotech, ICT and clean tech firms: Coping with knowledge leakage and legitimacy deficits |
| H201114 | 20-12-2011 | A conceptual overview of what we know about social entrepreneurship |
| H201113 | 20-12-2011 | Unraveling the Shift to the Entrepreneurial Economy |
| H201112 | 24-11-2011 | Bedrijfscriminaliteit |
| H201111 | 25-8-2011 | The networks of the solo self-employed and their success |
| H201110 | 23-6-2011 | Social and commercial entrepreneurship: Exploring individual and organizational characteristics |
| H201109 | 9-5-2011 | The relationship between firm size and economic development: The Lucas hypothesis revisited |
| H201108 | 22-3-2011 | Corporate Entrepreneurship at the Individual Level: Measurement and Determinants |
| H201107 | 30-01-2011 | Determinants of high-growth firms |
| H201106 | 13-1-2011 | Determinants of job satisfaction across the EU-15: A comparison of self-employed and paid employees |
| H201105 | 13-1-2011 | Gender, risk aversion and remuneration policies of entrepreneurs |
| H201104 | 11-1-2011 | The relationship between start-ups, market mobility and employment growth: An empirical analysis for Dutch regions |
| H201103 | 6-1-2011 | The value of an educated population for an individual's entrepreneurship success |
| H201102 | 6-1-2011 | Understanding the Drivers of an 'Entrepreneurial' Economy: Lessons from Japan and the Netherlands |
| H201101 | 4-1-2011 | Environmental sustainability and financial performance of SMEs |
| H201022 | 16-11-2010 | Prevalence and Determinants of Social Entrepreneurship at the Macro-level |
| H201021 | 20-10-2010 | What determines the volume of informal venture finance investment and does it vary by gender? |
| H201019 | 9-8-2010 | Measuring Business Ownership Across Countries and Over Time: Extending the COMPENDIA Data Base |

| | | |
|---|---|---|
| H201018 | 6-7-2010 | Modelling the Determinants of Job Creation: Microeconometric Models Accounting for Latent Entrepreneurial Ability |
| H201016 | 29-4-2010 | The Nature and Prevalence of Inter-Organizational Project Ventures: Evidence from a large scale Field Study in the Netherlands 2006-2009 |
| H201015 | 27-4-2010 | New Firm Performance: Does the Age of Founders Affect Employment Creation? |
| H201014 | 1-4-2010 | Van defensief MKB-beleid naar offensief ondernemerschapsbeleid |
| H201013 | 16-3-2010 | Human capital and start-up succes of nascent entrepreneurs |
| H201012 | 16-3-2010 | New business creation in the Netherlands |
| H201011 | 16-3-2010 | Factors influencing the entrepreneurial engagement of opportunity and necessity entrepreneurs |
| H201010 | 16-3-2010 | The more business owners the merrier? The role of tertiary education |
| H201009 | 2-3-2010 | Open, distributed and user-centered: Towards a paradigm shift in innovation policy |
| H201008 | 1-2-2010 | Geographical distance of innovation collaborations |
| H201006 | 21-1-2010 | Family ownership, innovation and other context variables as determinants of sustainable entrepreneurship in SMEs: An empirical research study |
| H201005 | 12-1-2010 | Intrapreneurship – An international study |
| H201004 | 12-1-2010 | Schumpeter versus Kirzner:<br>An empirical investigation of opportunity types |
| H201003 | 7-1-2010 | Institutions and entrepreneurship: The role of the rule of law |
| H201002 | 5-1-2010 | Patterns of innovation networking in Dutch small firms |
| H201001 | 4-1-2010 | Administratieve lasten en ondernemerschap |
| H200911 | 29-1-2010 | Ambitious entrepreneurship, high-growth firms and macroeconomic growth |
| H200910 | 4-2-2010 | Entrepreneurial exit and entrepreneurial engagement |
| H200909 | 10-3-2009 | Entrepreneurship Education Monitor (EEM) |
| H200908 | 3-3-2009 | Internationale samenwerking door het Nederlandse MKB |
| H200907 | 2-3-2009 | The Dynamics of Entry and Exit |
| H200906 | 2-3-2009 | Bedrijfsgrootteverdelingen in Nederland |
| H200905 | 2-3-2009 | Start-ups as drivers of incumbent firm mobility: An analysis at the region-sector level for the Netherlands |
| H200904 | 16-2-2009 | Een reconstructie van het beleidsprogramma Ondernemerschap en Starters 1982-2003: een eclectische analyse |
| H200903 | 16-2-2009 | Determinants and dimensions of firm growth |
| H200902 | 2-2-2009 | The decision to innovate: Antecedents of opportunity exploitation in high tech small firms |