Frontiers of Entrepreneurship Research

Volume 32 | Issue 9
CHAPTER IX. THE ORGANIZATION

Article 1

6-9-2012

THE RISK OF GROWING FAST: DOES FAST GROWTH HAVE A NEGATIVE IMPACT ON THE SURVIVAL RATES OF FIRMS?

Haibo Zhou
University of Groningen, h.zhou@rug.nl

Jan de Kok
Panteia/EIM

Chantal Hartog
Panteia/EIM

Peter van der Zwan
Erasmus University Rotterdam

THE RISK OF GROWING FAST: DOES FAST GROWTH HAVE A NEGATIVE IMPACT ON THE SURVIVAL RATES OF FIRMS?

Jan de Kok, Panteia/EIM, Zoetermeer, Netherlands
Haibo Zhou, University of Groningen, Groningen, Netherlands
Chantal Hartog, Panteia/EIM, Zoetermeer, Netherlands
Peter van der Zwan, Erasmus University Rotterdam, Netherlands

Abstract

Fast-growing firms are considered as the central drivers of job creation in the economy. There is an abundance of literature on the separate subjects of firm growth and firm survival. However, the relationship between survival and growth is neglected. Using the *Dutch Longitudinal Enterprise Database 1993-1999*, we investigate whether high employment growth rates in the recent past have a negative impact on firm survival. Our results do not find support for this relationship for the population of enterprises with a stable or growing employment development. Thus, we find no evidence that policies stimulating fast-growing firms may result in more firm deaths.

Introduction

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 extensively explored to determine their relationship with the probability of survival of the firm and firm growth (Audretsch, Klomp, Santarelli and Thurik, 2004; Begley and Boyd, 1987; McDougall, Robinson and DeNisi, 1992).

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. From a policy point of view, this suggests that 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. In this study, we investigate the impact of fast employment growth on the survival of the firm. More precisely, our research question reads: *Does there exist a relationship between (fast) employment growth in the recent past and firm survival, and – if yes – what does this relationship look like?*

The reminder of the paper is organized as follows: In section 2, we discuss existing literature on the possible effects of employment growth rates on firm survival. Data and research methodology are presented in section 3. The estimation results are presented in section 4. Section 5 presents discussions and conclusions.

Possible Effects of Growth Rates on Firm Survival

So far, little attention has been paid 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 section, we review some classical theories and discussions on firm growth and firm survival, and their main determinants (including firm size and firm age). Some stylized facts are generated to suggest that firm growth may indeed affect firm survival. We start with the definition of fast-growing enterprises.

Fast-Growing Enterprises

One of the first definitions of fast growing firms was provided by Birch, Haggerty and Parsons (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 OECD argued that "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). Compared to the earlier definition by Birch et al. (1995), this definition explicitly mentions that the growth rate should be determined over a three-year period, it restricts the group of fast growing enterprises to enterprises that grow organic, and it includes employment growth as well as turnover growth. In an OECD Working Paper it is even argued that the definition of fast growing firms should not be based on turnover growth (Ahmad, 2006, p. 57), since 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). Elsewhere, the OECD suggests to include a lower threshold of 10 employees to correct for possible overrepresentation of small organizations. In line with the arguments by Achmad (2006), we measure the growth rate of enterprises by the average employment growth rate over a three-year period, and focus on enterprises with organic growth.

Firm Growth, Firm Size and Firm Age

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. 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).

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.

Firm Survival

The positive relationship between firm size and likelihood of survival is consistently found in empirical studies (Audretsch and Mahmood, 1994, 1995; Dunne, Roberts and Samuelson, 1989; Geroski, 1995; Haveman, 1995; Mata and Portugal, 1994; Mitchell, 1994; 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.

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 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 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 adjustments during its evolution in order to survive and grow. Firms with a high employment growth in a short period 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 in the recent past may have a negative effect on firm survival rates.

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. Note that this negative relationship only applies at the aggregated level of size classes, but not at the level of individual firms[3].

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. Combined these two models, we argue that *an inverted U-shaped relation may exist between firm survival at t and firm growth prior to t.* 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.

Data and Methodology

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[4] 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).

Samples

Each observation in the Longitudinal Enterprise Database 1993-1999 represents a single enterprise in a single year. Each observation can be classified into exclusive groups according to the firm status, industries and growth types. The distributions of employer enterprises given different firm status (excluding pre-entry and post-exit) are presented in Table 1. The distribution of employer enterprises across the industries is presented in Table 2 (averaged over the period 1993-1997).

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[5]. The main reason for exit is "exit due to firm death" (which occurs on average for 3.5% of all economically active enterprises in a certain year). However, especially for the last two years in our database, the reason for exit is often unknown. This can be explained by the lags between formal registration of firm exit (as registered in the business registration data) and the economic exit of the firm: information on the reason for exit lags on average two years behind the actual exit[6].

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, we also distinguish various other enterprise growth types: fast-shrinking enterprises[7], fast-growing/fast-shrinking micro enterprises[8], other mutations[9] and stable enterprises[10]. According to our database, between 1996 and 1999 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).

Variables

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[11].

The main explanatory variable concerns the employment growth in the recent past. In line with the definition of fast-growing enterprises, we use 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. 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 main 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 [12].

An important part of the research question of this study is to determine the functional form of the relationship between employment growth rate and survival. Different functional forms are investigated, including a linear, quadratic and cubic function of the growth rates. The cubic term is incorporated 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 not derive any theoretical interpretation from it. To further investigate the effects of functional form, we include dummy variables in a different model that indicate different employment growth size classes[13]. This approach allows us to determine whether the exit rates of fast-growing enterprises are significantly higher than the exit rates of stable enterprises (controlling for size, industry and age) [14].

The number of control variables in our dataset is very limited; we can only control for size, industry and age. In the regression models we include the log of firm size (four years lagged). The size of the workforce 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. To account for the firm's sector of industry, we include dummy variables in the model covering the 14 industries 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.

Estimation Methodology

Given the nature of our dependent variable, 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.

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.

Results

Descriptive Statistics

Table 4 presents the distribution of the dependent variable in 1997 by industry and by firm size. As shown, exit rates due to firm death are on average highest in communication and lowest in construction. As the exit rate in construction is the overall lowest, this industry is marked as reference industry in the regression models. Exit rates decrease with firm size, from 2.9% for micro firms to 0.4% for large firms (Table 4). 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.

Regression Results

The model is estimated separately for firms employing no more than 10 employees in 1993[15] and for firms employing more than 10 employees in 1993. The results are presented in Table 5. In model A, we estimate different functional forms of the relationship with the lagged employment growth. The results of this model support the presence of an inverted U-shaped relationship: the linear effect of the employment growth rate has a significantly negative parameter while the quadratic effect has a significantly positive parameter. This is true for the group of micro enterprises, as well as for the group of larger enterprises (the cubic term is only included to limit any potential disturbing influence of outliers on the parameter estimates of the quadratic term).

Despite the significance of the estimated parameters of the linear and quadratic effect of the employment growth rate, we further investigate how big this effect is using dummies to categorize different firm growth rates[16]. Results in Model B of Table 5 show: 1) When we compare the parameter estimates of the four categories with negative employment growth rates to the base category of (almost) stable enterprises, we find that higher (i.e. less negative) employment growth rates are associated with lower exit rates. Most of the associated parameter estimates are significantly different from zero. 2) When we compare the base category to the five categories with positive employment growth rates, a different picture emerges: most of parameter estimates do not differ significantly from zero. This includes the parameter estimates for two of the three categories that constitute the group of fast-growing enterprises[17]. The parameter for the third (and highest) employment growth size class is significantly negative. However, this size class only includes 12 enterprises (out of the approximately 1300 fast-growing enterprises), and we treat this group as

a group of outliers. Without these outliers, the results indicate that the exit rate of fast-growing enterprises does not differ significantly from enterprises with a stable employment level (after correcting for size, industry and age). This becomes clear from Figure 1, which shows how the probability of exit due to firm death varies with the employment growth rate (based on the parameter estimates reported in Model B of Table 5).

To conclude, the results in Table 5 suggest that if we limit ourselves to enterprises with non-negative employment growth rates, growth rate and exit rate are independent of each other. To test whether this is indeed the case, we re-estimated model A for fast growing enterprises only (thus, it is limited to enterprises with more than 10 employees in 1993). This time, none of the estimated parameters of the cubic function differs significantly from zero. This is a further indication that there is indeed no relationship between employment growth rate and exit rate.

Regarding the control variables, the log of firm size three years ago has a negatively effect on the probability of exit due to firm death. This is in line with the stylised facts discussed in section 2. Our result holds for the micro firms as well as for the larger firms. As far as the enterprise's age is concerned, the results for the micro firms suggest a U-shaped relationship between firm age and exit rate: the probability of exiting due to firm death first decreases with firm age, between the ages of 4 to 14 years. After that, the probability of exiting due to firm death increases again. According to these results, the survival rates of micro firms are highest amongst enterprises of 10 to 25 years rather than amongst the oldest enterprises. The results for larger firms are more in line with the stylized facts: here, the survival rates are highest amongst firms aged 15 years or more.

Discussion and Conclusion

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.

Using the *Longitudinal Enterprise Database 1993-1999*, we investigate to what extent a recent period of fast employment growth has a negative impact on the survival of that enterprise (or, a positive impact on firm exit due to firm death), we estimate 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.

Our findings support an inverted U-shaped relationship between lagged employment growth rates and firm survival. This base model, however, suggests that this relationship may be better described by a declining convex curve, where the declining part of the curve mainly refers to the enterprises that face employment contraction. For these enterprises, the employment growth

rate is negatively correlated with the exit rate: for enterprises with a more negative employment growth rate, the exit rate is higher. For the majority of enterprises with a stable or growing employment development, there are however no clear indications of any relationship between employment growth rate and exit rate. We therefore conclude that there is no empirical support for our assumption that high growth rates have a negative impact on the survival rates of enterprises. From a policy perspective, we thus find no evidence that policies stimulating fast-growing enterprise may result in more firm deaths.

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, the model can be estimated for separate sectors of industry. A second 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.

CONTACT: Haibo Zhou; h.zhou@rug.nl; (T): +31 050-3638284; University of Groningen, Nettelbosje 2, 9747AE Groningen, Netherlands.

Notes

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.
3. 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.
4. Employer enterprises are enterprises with employees.
5. No information on paid employment is available for the year 2000.
6. 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.
7. Enterprises with an average three-year growth rate smaller than -0.2 that employed more than 10 employees three years ago and were not involved in mergers, take-overs or other mutations.
8. Enterprises with an average three-year growth rate greater than 0.2 or smaller than -0.2 that employed no more than 10 employees three years ago and were not involved in mergers, take-overs or other mutations.
9. Enterprises involved in mergers, take-overs or other mutations during the past three years that were not associated with firm entry or firm exit.
10. 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.
11. For firms that enter in year t, the survival status is not defined.
12. 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.

13. We distinguish 10 different categories which are defined by the following boundaries: -50%; -20%; -5%;-0.5%;0.5%;5%;20%;50%;100%.

14. This is possible, because the three largest categories constitute the group of fast-growing enterprises.

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

16. In addition, we included a dummy indicating enterprises with an average employment growth rate of 100% or more.

17. These are the three highest employment growth size classes for enterprises employing more than 10 employees in 1993.

References

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.

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.

Sutton, J. (1997), Gibrat's legacy, *Journal of Economic Literature* 35, 40-59.

Yasuda, T. (2005), Firm growth, size, age and behaviour in Japanese manufacturing, *Small Business Economics* 24(1), 1-15.

Table 1: Relative distribution of employer enterprises by firm status (1993-1998 in %)

Status	1993	1994	1995	1996	1997	1998	average
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

Table 2: Relative distribution of employer enterprises by sector of industry (1997 in %)

Industry	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

Source: Longitudinal Enterprise Database 1993-1999

Table 3: Relative distribution of employer enterprises by growth types (1996-1998 X1,000 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

Table 4: The share of enterprises existing in 1997 due to firm death, by industry and by firm size (in %)

Industry	Exit rate	Firm size	Exit rate
Manufacturing of food products; beverages and tobacco	4.0	Micro (1-9 fte)	2.9
Manufacturing of metals	1.9	Small (10-49 fte)	1.1
Manufacturing of chemicals and chemical products	3.0	Medium (50-249 fte)	0.6
Manufacturing n.e.c.	2.9	Large (>=250 fte)	0.4
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	Total	2.7

Source: Longitudinal Enterprise Database 1993-1999

Table 5: Multinomial logit model explaining firm exit due to firm death in 1997

	Model A				Model B			
	=<10 employees		>10 employees		=<10 employees		>10 employees	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
Intercept	-3.66	0.00	-3.80	0.00	-3.64	0.00	-4.08	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						
Dummies: Average three_year growth rate (lagged)								
< -50%					1.76	0.00	1.89	0.00
-50% to -20%					0.64	0.00	1.52	0.00
-20% to -5%					0.41	0.00	0.63	0.01
-5% to -0,5%					0.34	0.07	0.21	0.39
-0.5% to 0.5% (base category)								
0,5% to 5%					0.04	0.82	-0.29	0.28
5% to 20%					0.06	0.42	-0.04	0.87
20% to 50%					-0.21	0.00	-0.18	0.65
50% to 100%					-0.07	0.48	0.58	0.44
>100%					-0.31	0.22	-29.82	0.00
Log(firm size), 4 years lagged	-0.47	0.00	0.35	0.00	-0.56	0.00	-0.33	0.00
Dummies: Firm age								
4 years	0.46	0.00	0.67	0.08	0.50	0.00	0.61	0.10
5 years	0.46	0.00	0.94	0.00	0.47	0.00	0.90	0.00
6 years	0.41	0.00	0.63	0.03	0.42	0.00	0.61	0.03
7 years	0.12	0.19	0.67	0.01	0.13	0.15	0.65	0.02
8 years	-0.07	0.50	0.21	0.50	-0.06	0.56	0.18	0.60
9 years	-0.04	0.68	0.30	0.38	-0.04	0.74	0.29	0.38
10-14 years	-0.15	0.02	0.42	0.01	-0.14	0.02	0.41	0.01
15-24 years	-0.12	0.02	-0.20	0.17	-0.12	0.03	-0.20	0.17
≥ 25 years (base category)								
Industries	Included		Included		Included		Included	

**Dependent variable: 0=Continuous enterprises (base outcome); 1= Exit due to firm death; 2= Exit due to other reason (parameter estimates 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

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