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Entrepreneurship, Dynamic Capabilities and New Firm Growth

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Summary

This paper applies the dynamic capability framework to the study of new firm growth. Using a longitudinal database of 354 firms over their first ten years, we provide an explanation of new firm growth in terms of new product development, R&D, inter-firm alliancing, and exporting, activities that have been identified as denoting dynamic capabilities. In addition, an overview of empirical studies on employment growth in new firms is provided. The empirical evidence for this study shows that general firm resources have a much stronger effect on growth than the dynamic capabilities measured here (mainly inter-firm alliancing). High levels of human capital of the entrepreneur or resource-munificence of the firm does not improve the value of dynamic capabilities for growth. Environmental dynamism – a supposed boundary condition of the dynamic capability approach – is not revealed to be a moderating factor on the effect of dynamic capabilities on new firm growth.

Keywords: entrepreneurship, dynamic capabilities, start-ups, new firm growth.

1. Introduction

A key outcome of the entrepreneurial process is new business creation. Most new businesses employ only one or very few persons. These businesses face completely different issues during their life course than the few new firms that grow substantially. These growing new firms are under pressure to act strategically, especially with respect to the expansion and renewal of their resource base (e.g. via organizational learning), innovation, alliances and possibly internationalisation. Strategic entrepreneurship (Hitt et al., 2001) is a core issue here, especially the use of dynamic capabilities (Eisenhardt and Martin, 2000). Most studies on dynamic capabilities have focused on large, established firms. Thus far there have been no studies tracing the effect of dynamic capabilities on the growth of new firms. This paper will analyse the role of dynamic capabilities in new firm growth, controlling for measures of firm resources, characteristics of the entrepreneur, and aspects of the environment. The central research question is: To what extent do dynamic capabilities affect the growth of new firms?

The paper opens with a review of empirical studies on employment growth in new firms and then moves on to a discussion on the role of dynamic capabilities in the explanation of new firm growth. After a description of the data and variables we discuss the results and implications of this study.

2. Review of empirical studies on employment growth of new firms

So far there have been no studies tracing the effect of dynamic capabilities on the growth of new firms.¹ There have been several empirical studies that have analysed the determinants of employment growth in new firms. These studies are summarised in table 1. This table does not give an exhaustive overview of all determinants that have been used in these studies, but all determinants that have been used in at least two studies are represented. An overview of the characteristics of the samples on which these studies are based is provided in the appendix. We have categorized the determinants of the growth in employee numbers in new firms into three sets of factors. Personal level determinants include human capital, social capital, and ambitions of the entrepreneur; firm level determinants include organizational capital and financial capital; variables related to the business environment of the firm are industry or geographical location. Table 1 shows that the outcomes of these studies are very scattered: hardly any study takes a similar set of determinants into account, and when the same determinants are taken into account sometimes contrasting outcomes are presented.

Consensus is to be found to the greatest extent regarding personal level determinants. The human capital variables educational level, start-up experience, industry experience and technical experience have generally been found to have a positive effect on growth. Being a female founder or belonging to an immigrant group often has a negative effect on growth. Social capital, especially in the form of starting a firm with (a) business partner(s) has a consistent positive effect on subsequent firm growth. A positive start-up motivation to realize an idea or innovation also has a positive effect. Regarding the firm level determinants two factors have a consistent positive effect: the level of start-up capital and being incorporated. Among business environment determinants, starting in retail/personal services seems to have a negative effect, while starting in manufacturing/construction seems to have a positive effect on growth.

There is controversy on the effect of work experience and of the initial (employment) size of the firm. On the one hand work experience might provide opportunities for on the job-learning, leading to valuable knowledge for managing a growing business. However, this depends on type of activity and type of organization in which experience has been gained. Entrepreneurs with lengthy work experience could become more cautious and conservative than entrepreneurs with shorter work experience.

¹ There have been some studies on how certain aspects of dynamic capabilities affect other indicators of new firm growth like sales growth (Lee et al., 2001) or on the probability of IPO.

Table 1 - Empirical studies on employment growth of new firms

		<i>Cooper et al. 1994</i>	<i>Dahlqvist et al. 2000</i>	<i>Schutjens & Wever 2000</i>	<i>Bosma et al. 2004</i>	<i>Vivarelli & Audretsch 1998</i>	<i>Colombo & Grilli 2005</i>	<i>Almus & Nerlinger 1999</i>	<i>Brüderl & Preisendörfer 1998</i>
Human capital	Education level	+		0	0		+		0
	Immigrant	-	-						0
	Self-employed parents	0				0			
	Management experience	0		0		+	0		0
	Unemployment		0			0			
	Self-employment / start-up experience		+		0		+		0
	(Long) work experience			-	+				-
	Industry experience			0	+		+		0
	Technical experience						+	+	
	Male founder	+	+		+				+
Age entrepreneur			0	0		+			
Social capital	Entrepreneurial networks				+				0
	Emotional support from spouse				0				0
	Business partners	+		+			+	0	0
Ambitions	Start-up motivation: market need/niche		0			0			
	Start-up motivation: realize idea/ innovation		0			+	+		
	Goal: sales growth			0					
	Goal: employment growth				+				
	Start-up motive: higher income / profit				0	+			
Financial capital	Start-up capital	+		0			+		+
Organizational capital	Incorporation		+	0				+	+
	Start-up preparation			+					
	Start-up size: sales			+					
	Start-up size: employees			+				-	0
	Start-up size: number of hours worked				+				
	Start-up of take-over								-
	Diversified (products)							+	
Environment	Industry: retail or personal services	-	-	0					0
	Industry: restaurant								0
	Industry: wholesale trade								0
	Industry: transportation								0
	Industry: manufacturing/construction			+		+			0
	Industry: high-tech manufacturing							+	
	Industry: business services			+	0	0			0
	Metropolitan location		0	0				0	
	Rural location		-	0					

Contrasting evidence has been found on the effect of the initial employment size on subsequent firm growth. In the industrial economic literature it is a stylized fact that young and small firms grow relatively fast, because they have to achieve the minimum efficient size (MES) in their industry (Mansfield, 1962; Audretsch et al. 2004). Initial size has been found to have a negative effect on firm growth in these studies (Audretsch et al., 1999; Lotti et al. 2001). Smaller start-ups thus have a higher need to grow (Davidsson, 1991). On the other hand, relatively large start-ups have more resources at hand to realize growth and are more likely to attract financial capital and human resources, which enables them to grow more rapidly than small start-ups. These large start-ups may also be more ambitious regarding future growth. This effect can be traced by controlling for growth ambitions.

3. Dynamic Capabilities and New Firm Growth

Entrepreneurship results in the creation of new firms. Growing a firm to a substantial size involves strategic activities that have been termed strategic entrepreneurship (Hitt et al., 2001). It is necessary for entrepreneurs to create and adapt the resource base of the new firm. New firms often face resource base weaknesses (Garnsey, 1998; West and DeCastro, 2001) and are confronted with subsequent performance shortfalls if these weaknesses are not dealt with. As such, new firms must demonstrate dynamic capabilities to reconfigure the resource base as needed (Teece et al., 1997; Eisenhardt and Martin, 2000). Dynamic capabilities are the organizational and strategic routines by which firms achieve new resource combinations (Eisenhardt and Martin, 2000, p. 1107). They include specific and identifiable processes such as new product development, R&D, inter-firm alliancing, and exporting. With new product development routines the varied skills and backgrounds of firm members are combined to create revenue-producing goods and services. With knowledge creation routines (also known as R&D) new knowledge is built within the firm of particular strategic relevance in high-tech industries. Alliancing routines bring new resources into the firm from external sources, also often essential in high-tech industries (Powell et al., 1996; Baum et al., 2000; Tapon et al., 2001). Strategic decision making, for example regarding the entrance into new (international) markets is also a dynamic capability in which firm members pool their various business, functional, and personal expertise to make the choices that shape the major strategic moves of the firm.

Thus entrepreneurs can create and adapt the resource base of the new firm with R&D activities, developing new products, introducing products to foreign markets, and alliancing with other firms (Eisenhardt and Martin, 2000). These dynamic capabilities are central elements of strategic entrepreneurship. If an entrepreneur is able to build these dynamic capabilities early on in the life course of the firm, this will increase the likelihood of sustained growth of the new firm.

4. Hypotheses

We hypothesize that new firms with dynamic capabilities are more likely to grow but that human capital, firm resources, and environmental dynamism enhance/moderate the effect of dynamic capabilities on firm growth.

In line with the above explanation of new firm growth in terms of dynamic capabilities, the first hypothesis can be stated as:

Hypothesis 1: New firms with dynamic capabilities are more likely to grow.

Only few new firms are likely to build dynamic capabilities and these capabilities are not valuable in every context. There may be certain preconditions for the proper functioning of dynamic capabilities. On the personal level, the knowledge base of the entrepreneur enables the effective use of dynamic capabilities.

Hypothesis 2: The level of human capital of the entrepreneur will moderate the relationship between dynamic capabilities and growth.

On the organisational level, a munificent resource base would provide the means to create and use dynamic capabilities effectively. The presence of multiple firm members may be a prerequisite for the existence of (dynamic) capabilities (Felin and Foss, 2006).

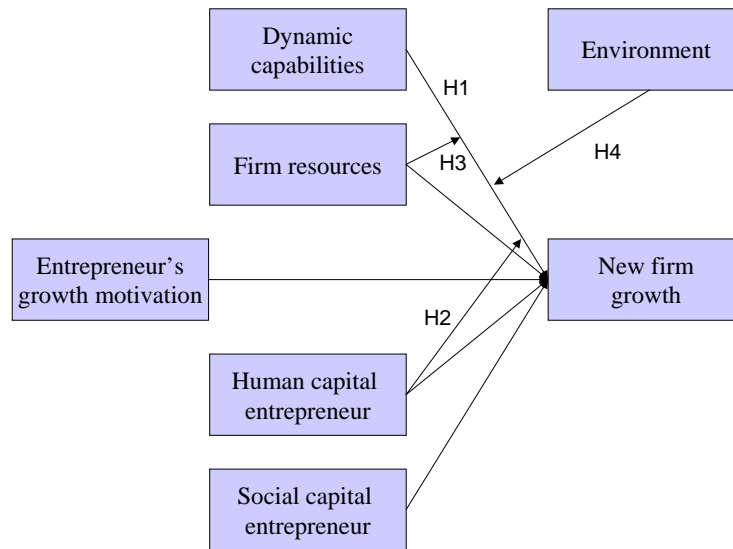
Hypothesis 3: The level of firm resources will moderate the relationship between dynamic capabilities and the likelihood of growth.

As regards business context, theorists have argued that dynamic capabilities are especially valuable in (technologically) dynamic environments (Teece et al., 1997; Eisenhardt and Martin, 2000).

Hypothesis 4: The relationship between dynamic capabilities and the likelihood of growth is contingent on environmental dynamism.

The hypothesized effects and the determinants that have been found in the review of empirical studies are summarized in figure 1.

Figure 1 - Determinants of employment growth in new firms



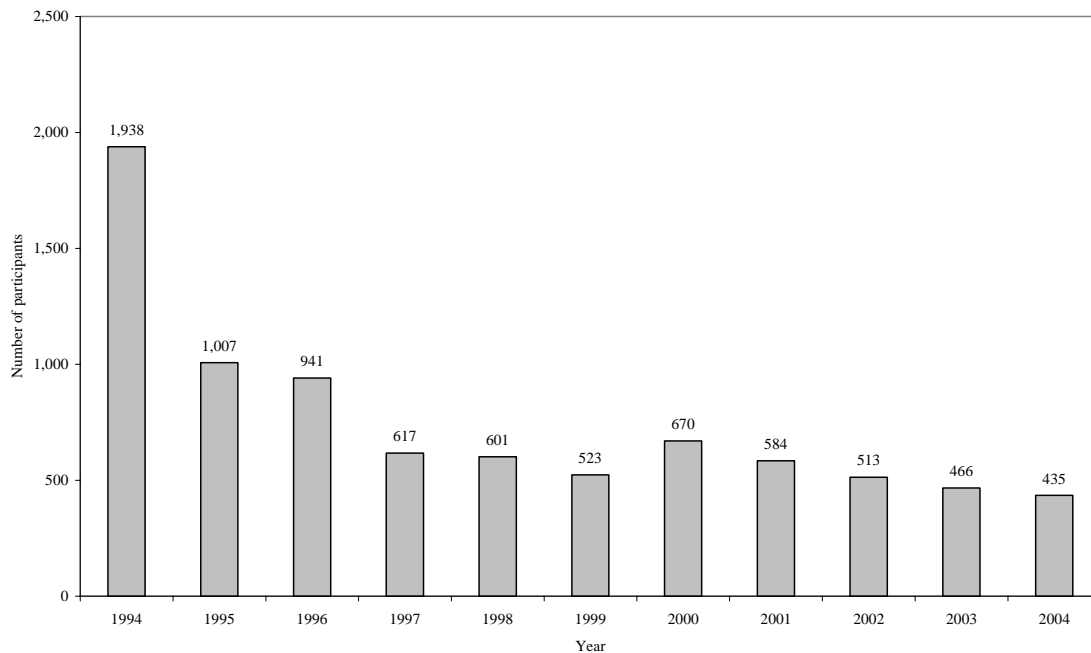
5. Data

The data used for this study are based on the ‘Start-up panel: cohort 1994’. This panel has been set up by EIM Business and Policy Research (hereafter EIM). We will shortly describe the start-up panel and the sample characteristics.

5.1 Start-up panel

The population in this panel consists of firms in the Netherlands that started their business in 1994. These firms were registered as independent start-ups in 1994. Approximately 12 000 firms have been approached of which almost 2 000 start-ups agreed to participate in the panel in 1994. These firms have been followed since 1994. From 1994-1999 the participants received a questionnaire by mail, while in the period of 2000-2004 the participants were approached through computer assisted telephone interviewing (CATI). In 2000 previous participants were traced and approached. The number of participants therefore increases from 1999 to 2000. Throughout the years only 23% of the initial participants remained in the panel. Some participants refused to participate in the panel in later years, ceased economic activities, went bankrupt or moved and could not be traced. The number of participants in the start-up panel for the period of 1994-2004 is presented in figure 2. It shows that 435 firms remained in the study from start up and over the decade. Other studies have taken the age of 10 years as a boundary for new firms (Barron et al. 1996; Certo et al. 2001).

Figure 2 - Number of participating firms in the EIM start-up panel



The firms in the start-up panel were interviewed on such subjects as the characteristics of the firm and entrepreneur, finance, bottlenecks, strategy and goals, market and environment, realizations versus expectations. The main themes have largely remained the same over the years. Therefore the dataset not only contains information about the initial founding conditions, but also information over the life course of the firm.

It must be noted that our study may suffer from survival bias: only the firms that survived during the ten years (over the 1994-2004 period) were included in our research sample.

5.2 Sample characteristics

Of the 435 respondents that were still in the panel in 2004, 354 firms for which the complete growth paths could be identified are analysed here. The entrepreneurs in the sample are most often male (72%) and are often highly educated (71% has a bachelor or master degree). The age of the entrepreneurs in the start-up panel ranges from 19 to 61 years in 1994. The average age in 1994 was 38 years.

The distribution of the firms across industries is as follows: manufacturing (10%), construction (10%), retail and repairs (19%), wholesale (14%), catering (4%), transport and communication (4%), business services (26%) and other services (13%). The industrial distribution of start-ups in the Netherlands in 1994 in the sector construction and transport & communication is similar as in the panel. Furthermore the industrial distribution shows that the sectors manufacturing (NL: 6%) and retail & repairs (NL: 16%) are slightly

overrepresented in the panel. The sectors catering (NL: 6%), business services (NL: 28%) and wholesale (NL: 19%) are slightly underrepresented in the panel.

On average, the firms in the panel employed 3.8 persons in 2004. The average employment creation of a start-up in 1994 was 1.7 persons. The Dutch definition of SMEs includes all firms with less than 100 employees. None of the firms in the panel has grown so rapidly since 1994 that it has become a large firm. In fact 63% of the firms in the panel did not have any employees next to the business owner at all in 2004.

6. Variables

6.1 *Dependent variables*

Growth. Growth of firms can be measured in terms of inputs (e.g. employees), value (e.g. assets) or outputs (e.g. profits). Here growth is measured by viewing the number of employees. Not all firms follow a similar growth path when they grow. Four types of growth paths are explored; continuous growth, growth setbacks, early growth and/or plateau and delayed growth (cf. Garnsey et al., 2006).

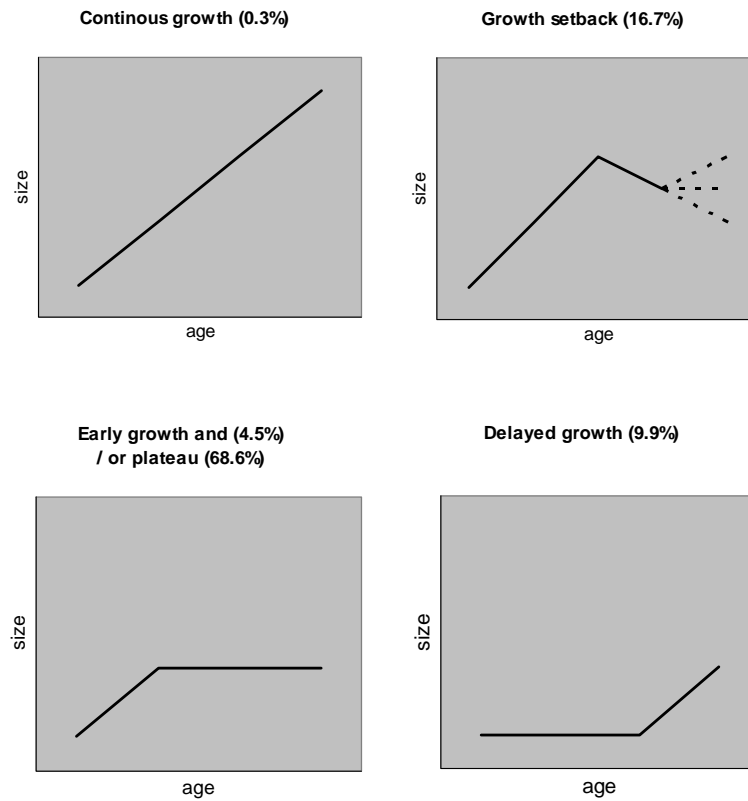
The growth paths of the 354 firms that survived the first ten years of existence are presented in figure 3.² Only one firm has grown continuously over the ten year period. By far the greatest group of firms (68.6%) has never grown during the period studied. A substantial group of firms (16.7%) has faced a setback during their life course, while 4.5% of the firms have seen their growth stagnating. Almost 10% of the firms only started to grow some years after start-up.³

In order to execute reliable regression analyses a distinction is made between the new firms that grew (31.4%) and the majority (68.6%) that did not grow at all during the first ten years of existence.

² These growth paths are based on 5% employment change thresholds; we also used 10% employment change thresholds in another analysis, this however hardly changed the distribution of growth paths over the sample (only the number of firms in the setback category was significantly less in the 10% analysis).

³ These numbers are different from the Garnsey et al. (2006) study, because they analysed a cohort of firms in the 1990-2000 period (thus before the early 2000s recession) and their sample only included incorporated firms (and thus excluded sole-proprietors, which make up the majority of our sample). These differences might be responsible for the relatively small percentage of continuously growing firms, and the relatively high percentage of plateau firms.

Figure 3 - Growth paths of new firms



A *threshold 10 employees* is taken to show that a multi-person firm has been created. By our measure of growth this level had to be reached within the first ten years of existence. This measure is somewhat more strict than the first measure of growth (only 12% of the firms reached this threshold once during their early life course), giving a better indication of the creation of a substantial firm. A similar threshold of 10 employees has been used in other studies like the Baron et al. (1996). Most firms never cross this threshold; more than 93% of the firms in the European business population has less than 10 employees (Aldrich, 1999, p.11). In our sample only 41 firms had reached the 10 employees threshold once during the 10 post-entry years. Of these firms 41 firms, 23 had started without any employees, and only 6 had started with 10 or more employees. This measure is thus an indicator of growth in most cases, and not just an indicator of a large initial size.

6.2 Independent variables

Dynamic capabilities. To measure dynamic capabilities, four variables were used to capture the types of processes that have been labelled as dynamic capabilities in the literature

(see Eisenhardt and Martin, 2000). These four variables are: R&D activities, developing new products, introducing products to foreign markets and alliancing with other firms.

Different firm resources can be distinguished: financial capital and organizational capital.

Financial capital. Financial capital is measured by the amount of start-up capital.

Organizational capital. Two indicators of organizational capital have been used: whether the firm has been established through takeover and the start-up size of the firm in 1994 in terms of the number of employees.

Two types of capital on the person level are distinguished: social capital and human capital.

Social capital. Social capital is measured by the following variables: entrepreneurial family/friends, entrepreneurs that have contact with other entrepreneurs in a network next to business contacts (entrepreneurial networks), and the number of business partners (entrepreneurial team).

Human capital. Knowledge and experience of the entrepreneur is measured by general and more specific human capital indicators. The general human capital indicator that has been used is the educational level of the entrepreneur. The more specific human capital indicator experience has been taken up in analyses on different fields: earlier experience as a business-owner, leadership experience, human resource management experience, experience with financial management, technical experience (in current profession) and industry experience.

Environmental dynamism. Four indicators of environmental dynamism have been taken into account: rapid technological change and turbulence. The variable rapid technological change refers to the situation in the industry of the entrepreneur whereby he/she must be on the lookout for technological changes to anticipate on. In addition a variable reflecting the technology base of the firm is taken into account, indicating whether the firm's activities are based on new basic technologies (new materials, biotech, medical technology, information technology, energy/environmental technology). The variable turbulence has been composed by adding up the annual number of entries and exits per industry in 1994. The fourth variable is urban location.

Controls. Different control variables have been included in the analyses: the (employment) growth ambitions of the entrepreneur, the age and gender of the entrepreneur.

Whether growth firms were overrepresented in certain industries was checked. Growth firms were overrepresented in the retail, catering, transport and communication industries, and underrepresented in financial and business services, and personal services. The 10 employees threshold was more often achieved in the catering, and less often achieved in personal services.

The independent and dependent variables are presented in table 2. The binary and ordinal variables are defined in such a way that the lowest value indicates that the aspect is not present and the highest value indicates that the aspect is present.

Table 2 -Variables in analysis

<i>Variables</i>	<i>Type</i>	<i>Valid observations</i>	<i>Min.</i>	<i>Max.</i>	<i>Mean</i>
New product development	binary	345	1	3	1.44
R&D activities	binary	346	0	1	0.09
Inter-firm alliancing	binary	350	0	1	0.32
Export	binary	350	0	1	0.09
Start-up capital (x 1 000)	ordinal	349	1	7	2.65
Entrepreneurial family/friends	binary	348	0	1	0.37
Entrepreneurial networks	ordinal	351	1	3	1.58
Entrepreneurial team	continuous	347	0	3	0.07
Take-over	binary	350	0	1	0.11
Start-up size: employees	continuous	353	0	40	0.61
Educational level	binary	344	0	1	0.30
Earlier experience in running an enterprise	ordinal	349	0	1	0.06
Leadership experience	ordinal	349	1	4	2.52
Human resource management experience	ordinal	349	1	4	1.83
Experience with financial management	ordinal	349	1	4	2.05
Technical experience (in current profession)	ordinal	349	1	4	3.10
Industry experience	binary	344	0	1	0.62
Dynamic industry	ordinal	353	3	17	12.07
Rapid technological change	binary	351	0	1	0.35
Gender entrepreneur (male = 1; female = 0)	binary	353	0	1	0.72
Age entrepreneur in 1994	continuous	349	1	3	1.83
(Employment) growth ambitions	binary	351	1	4	2.10
Technology-based firm	binary	347	0	1	0.64
Urban environment	binary	352	0	1	0.11
Growth	binary	353	0	1	0.31
10 employees threshold reached once	binary	353	0	1	0.12

7. Results

7.1 Correlation analysis

Correlation analyses may be performed to identify the determinants which by our measures influence growth and to check whether the independent variables are highly correlated with each other. High correlation among independent variables may disturb assessment of the relationship through regression analysis. The correlations between the independent and dependent variables have been checked and no high correlations were found. The correlation coefficients between growth and its determinants are presented in table 3.

7.2 Logistic regression

The hypotheses were tested using logistic regression analysis, used to model dichotomous outcomes by modelling the log odds of an outcome in terms of the values of covariates in the model. Multinomial regression analysis could not be performed with the growth paths due to a too small number of observations for each growth path. The results on the explanation of firm growth are displayed in table 4. The dynamic capability variables and the individual and firm level variables were first entered in a base model reported in the first column of the table. This model contains some statistically significant effects: consistent effects in both the growth and the 10 employees threshold model are the start-up size (positive), start-up capital (positive), and age of the entrepreneur (negative). If the start-up size increases with one employee, the odds ratio (probability that firm grows/probability firm does not grow) that the firm grows then increases with factor 2 ($\text{EXP}(0.688)$), when other variables are controlled. Similarly, if the start-up capital increases with 1000 EUR, the odds that the firm grows then increase with a factor 1.2. The older the entrepreneur, the odds that the firm grows decreases with factor 0.49. The factors associated with the 10 employees threshold - start-up size, start-up capital and age entrepreneur – are also important determinants of firm growth in general. Growth ambitions and inter-firm alliancing only had positive effect on growth.

Table 3 - Correlations between growth, threshold 10 employees and the determinants⁴

<i>Determinants</i>	<i>Growth</i>	<i>Threshold 10 employees</i>
Dynamic capabilities		
New product development	-0.001	0.062
R&D activities	0.020	0.161 **
Inter-firm alliancing	0.117 *	0.108 *
Export	0.049	0.07
Financial capital		
Start-up capital (x 1 000)	0.338 **	0.288 **
Social capital		
Entrepreneurial family/friends	0.035	-0.050
Entrepreneurial networks	0.178 **	0.107 *
Entrepreneurial team	0.154 **	0.081
Organisational capital		
Take-over	0.295 **	0.126 *
Start-up size: employees	0.281 **	0.384 **
Human capital		
Educational level	-0.036	-0.036
Earlier experience in running an enterprise	0.056	-0.057
Leadership experience	0.200 **	0.157 **
Human resource management experience	0.185 **	0.163 **
Experience with financial management	0.109 *	0.074
Technical experience (in current profession)	0.108 *	0.169 **
Industry experience	0.060	0.084
Environmental dynamism		
Turbulence	-0.150 **	-0.116 *
Rapid technological change	0.04	0.114 *
Technology-based firm	-0.101	-0.012
Urban environment	-0.135 *	-0.04
Controls		
Gender entrepreneur	0.132 *	0.032
Age entrepreneur in 1994	-0.173 **	-0.088
(Employment) growth ambitions	0.402 **	0.233 **
***	Correlation is significant at the 0.01 level	
**	Correlation is significant at the 0.05 level	
*	Correlation is significant at the 0.10 level	

⁴ Pearson correlation coefficient has here been used as an indicator. The significance levels of Pearson are namely similar to the chi-square test of independency (linear-by-linear association).

Table 4 - Results of regression analysis for growth and threshold 10 employees

<i>Determinants</i>	<i>Growth</i>	<i>Threshold 10 employees</i>
Constant	-3.531 ***	-5.168 ***
<i>Dynamic capabilities</i>		
New product development	-0.007	0.250
R&D activities	-0.696	1.186
Inter-firm alliancing	0.690 **	0.741
Export	0.384	0.408
<i>Financial capital</i>		
Start-up capital (x1 000)	0.182 *	0.340 **
<i>Social capital</i>		
Entrepreneurial family/friends	-0.009	-1.366 **
Entrepreneurial networks	0.356	0.100
Entrepreneurial team	0.641	0.474
<i>Organisational capital</i>		
Take-over	-0.015	-1.139
Start-up size: employees	0.688 **	0.815 **
<i>Human capital</i>		
Educational level	-0.242	-0.495
Earlier experience in running an enterprise	0.294	-0.646
Leadership experience	0.289	-0.107
Human resource management experience	0.130	0.515
Experience with financial management	-0.089	0.005
Technical experience (in current profession)	0.089	0.526
Industry experience	-0.069	0.739
<i>Controls</i>		
Gender entrepreneur	0.061	-1.044 *
Age entrepreneur in 1994	-0.705 ***	-0.976 **
(Employment) growth ambitions	0.528 ***	0.215
N	308	308
Nagelkerke R Square	0.417	0.490

*** Correlation is significant at the 0.01 level.

** Correlation is significant at the 0.05 level.

* Correlation is significant at the 0.10 level.

These first analyses give only weak evidence for the positive effect of dynamic capabilities on new firm growth. We can thus confirm our first hypothesis to a limited extent. General firm resources seem to have a much stronger effect on new firm growth.

No significant effects of the human and social capital variables have been identified in multivariate analyses, even though significant correlations had been found in the bivariate analyses. The only exception is the strong negative effect of having entrepreneurs within the circles of friends and family on reaching the 10 employees threshold.

According to our second and third hypothesis the effect of dynamic capabilities on new firm growth depends on the knowledge base of the entrepreneur and/or on the level of firm resources.

On the personal level, the knowledge base of the entrepreneur was expected to enable the effective use of dynamic capabilities. The knowledge base has been measured by following variables that are significantly correlated with dynamic capabilities: educational level, technical experience and industry experience. No positive interaction effects of these variables with dynamic capabilities could be traced. Variable leadership experience, which is also significantly correlated with dynamic capabilities, has not been included here since this aspect is rather a management skill than an indication of the knowledge of the entrepreneur.

On the organisational level, a munificent resource base was hypothesized to provide the means to create and use dynamic capabilities effectively. However, in the models with the interaction effects of human resources and financial resources, no changes in the effect of dynamic capabilities could be traced.

The models with the interaction effects of personal knowledge and firm resources (start-up size) hardly changed the effect of the dynamic capabilities⁵. Thus, the second and third hypotheses are not supported; no moderating effect of the level of human capital and/or firm resources has been found.

Environments with rapid technological change are often assumed to provide relatively many entrepreneurial opportunities, and would thus be likely to stimulate firm growth. We found no positive effects of any kind of dynamic environment. Turbulence and urban location have a significant negative (!) effect on reaching the threshold of 10 employees and growth in general respectively.

Dynamic capabilities are said to be most valuable in dynamic environments, such as environments with rapid technological change. Thus, it may be expected that dynamic capabilities have a (stronger) effect in environments of rapid technological change. The relationship between dynamic capabilities and firm growth/threshold 10 employees is analysed in a sub sample of firms that operate in an environment of rapid technological change. However, for firms operating in an environment subject to rapid technological change, the effect of inter-firm alliancing on growth and threshold 10 employees vanishes. The same applies for firms in turbulent industries. However for the 10 employees-threshold

⁵ Regression models with the interaction effects are available from the authors.

model a remarkable outcome emerged: a positive effect of new product development in environments of rapid technological change, though only on a 10% significance level.

Table 5 - Results of regression analysis including environmental dynamism

<i>Determinants</i>	<i>Growth</i>	<i>Threshold 10 employees</i>
Constant	-2.985 ***	-3.652 **
Dynamic capabilities		
New product development	0.022	0.071
R&D activities	-0.542	1.275
Inter-firm alliancing	0.815 **	0.931 *
Export	0.517	0.457
Financial capital		
Start-up capital (x 1 000)	0.157	0.277 *
Social capital		
Entrepreneurial family/friends	0.091	-1.481 **
Entrepreneurial networks	0.427 *	0.314
Entrepreneurial team	0.608	0.258
Organisational capital		
Take-over	0.001	-1.385
Start-up size: employees	0.737 ***	0.954 ***
Human capital		
Educational level	0.092	-0.207
Earlier experience in running an enterprise	0.350	-0.513
Leadership experience	0.278	-0.197
Human resource management experience	0.111	0.528
Experience with financial management	-0.068	0.035
Technical experience (in current profession)	0.137	0.522
Industry experience	-0.106	0.922
Environmental dynamism		
Dynamic industry	-0.051	-0.140 **
Rapid technological change	-0.196	1.026
Technology-based firm	-0.324	-0.294
Urban environment	-1.497 *	0.469
Controls		
Gender entrepreneur	0.232	-1.028
Age entrepreneur in 1994	-0.778 ***	-1.198 ***
(Employment) growth ambitions	0.518 ***	0.237
N	303	303
Nagelkerke R Square	0.451	0.531

- *** Correlation is significant at the 0.01 level.
- ** Correlation is significant at the 0.05 level.
- * Correlation is significant at the 0.10 level.

Another indicator of the importance of technological change is whether or not the firm’s activities are based on a new basic technology. Therefore it was tested whether dynamic capabilities were more useful for technology-based firms than the population of firms in general. Among technology-based firms only inter-firm alliancing (of the dynamic capabilities) was found to have a positive effect on ‘growth’ and ‘threshold 10 employees’, just like in the general population.

The analyses provide only very limited support for the fourth hypothesis which states that environmental dynamism is of influence on the relationship between dynamic capabilities and growth. The positive effect of inter-firm alliancing even vanishes in turbulent industries and for firms that operate in environments of rapid technological change. Only a relatively weak positive effect of new product development of reaching the 10 employees-threshold in environments of rapid technological change could be found.

The outcomes of the analyses are summarized in figure 3 (growth in general) and 4 (10 employees-threshold).

Figure 3 - Determinants of employment growth of new firms in general

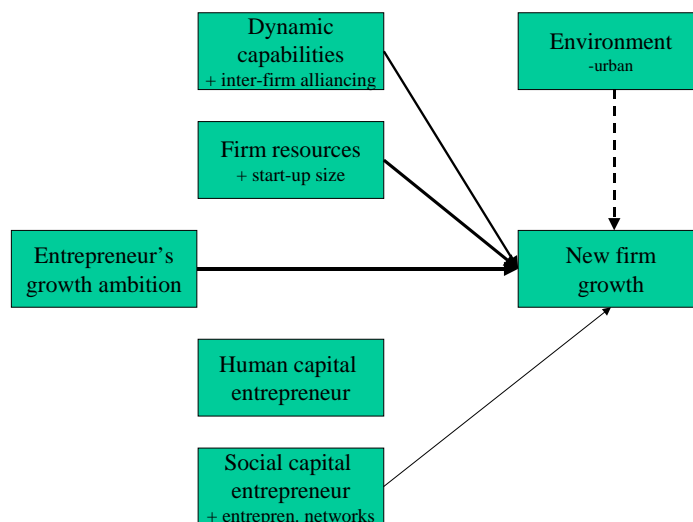
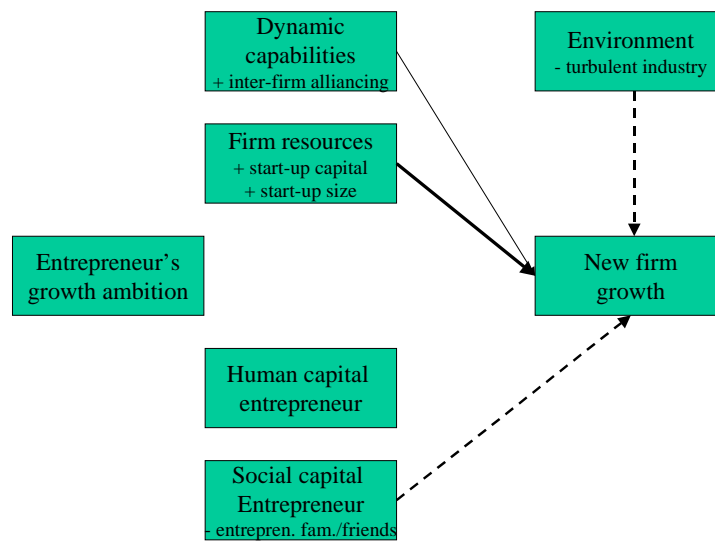


Figure 4 - Determinants of reaching the 10 employees threshold



8. Discussion

Regarding the dynamic capabilities, inter-firm alliancing is revealed to have a rather consistent positive effect on firm growth and achieving the 10 employee-threshold. Its effect turned out to be less constricted than expected. R&D and internationalization had no effect at all on growth. Only in dynamic technological environments did new product development turn out to have a (weak) positive effect for achieving the 10 employee-threshold. New product development did not reveal to have any effect on firm growth in all other environments.

Assumed opportunity rich environments – environments with rapid technological change, turbulent industries, and urban environments – turned out to have no main effect on growth or even a negative effect in some models.

The proposed moderating effects of personal knowledge and firm resources on the effect of dynamic capabilities on firm growth have not been found in this study.

General resources, like start-up capital and human resources turned out to have rather consistent positive effects, while the age of the entrepreneur had a consistent negative effect. Employment growth ambitions had a strong positive effect on firm growth in general, but surprisingly no effect on reaching the 10 employees threshold. It seems that for example a large initial size is much more important here than growth ambitions per se. Another surprising outcome was the negative effect of having entrepreneurial family/friends on

reaching the 10 employees threshold. Perhaps it is true that “ties that bind can easily turn into ties that blind” (Grabher, 1993) in the case of firm growth.

9. Limitations

In 1994 the panel consisted of approximately 2 000 start-ups. For our analysis only 354 cases were used. It is very important to know why an exit from the panel occurred, because of possible biases in our results. We only have used data about the start-ups which survived and were willing to participate, not about the start-ups that left the panel. For example: if a certain start-up left the panel because he had no time or was not interested in participation, it does not necessarily mean that his venture was doing badly. Maybe it was going so well, that he or she needed more time to invest in the venture to keep up the success. It is a totally different case when the non-participation is caused by the bankruptcy of the firm, which also leads to exit from the panel. Unfortunately, there is very little reliable information about the nature of the non-survival of the start-ups in our panel. Some respondents did not participate each year; they often skipped one or several years. This makes it more difficult to check in which year a respondent really exited the panel. Above all it was often not known why the respondent did not participate in a certain year or exited the panel altogether. An additional ‘exit’- survey was held, which did contain some more information about why a venture left the panel. However, this additional survey was only performed among a fraction of all the ventures.

Strategy is mentioned in literature as a mediating factor between capabilities and growth (Wiklund, 1998; Edelman et al., 2005). Our research may be extended with this variable.

Approaches like organizational ecology (Hannan and Freeman, 1984) and evolutionary economics (Klepper, 2002) argue that initial conditions at founding are of decisive importance for explaining the long term performance of organizations. Several empirical studies have shown the long-term influence of initial conditions on the performance of new firms (Geroski et al. 2006; Hannan et al. 2006). This does not imply that changing post-entry conditions do not matter. Even though the explained variance of our models are relatively high (ranging from 0.417 to 0.513), we should not expect that initial conditions only provide the best explanation of the growth of new firms over a ten year period. The changing conditions (both firm-internal as firm-external) are likely to provide additional explanatory power of firm growth over the early life course of firms (see figure 5). This is also in line with the argument that dynamic capabilities must be built through experience (Teece et al. 1997); this experience can of course be built up prior to the creation of the firm, but if it is to be a distinctive asset of the firm (i.e. firm-specific) it is more likely to be built over the years in the early life course of the firm.

10. Future research and implications

The above limitations provide further avenues for potential future research. Even though we have shown that initial conditions have a major influence on the long term growth of new firms, there is additional insight to be gained in the growth process by investigating the post-entry dynamics of the firm. Prior longitudinal studies have shown that firm growth is not a linear process, and may take off or be constrained in later phases of the life course. These dynamics in the growth paths may be explained by (random) external shocks (Geroski, 2005), but are more likely to be explained by the inherent problems of firm growth and the changing ability of firms to solve these problems and accumulate firm-specific competences (Penrose, 1959; Garnsey, 1998) and dynamic capabilities (Arthurs and Busenitz, 2006)⁶.

Next to these problem-driven mechanisms, more opportunity-driven mechanisms (innovation) might be important in this respect. The EIM start-up panel offers the unique opportunity to trace the emergence of problems and opportunities during the growth paths of new firms (cf. Stam and Schutjens 2006), and also to take into account the subsequent solution of these problems and the associated learning efforts and investments by these firms over time. This problems-solving and learning could be an important input for the development of organizational capabilities later on in the life course of these new firms (cf. Zahra et al. 2006). Until now such analysis on the growth and problem-solving of new firms has mainly been done with case studies (see e.g. Hugo and Garnsey 2005; Stam and Garnsey 2006). Future large scale quantitative research analysing the changing conditions (both firm-internal as firm-external) will deliver insights into whether the dynamic capabilities are developed during the life course of the firm and whether they are effective in changing the resource base of the firm in order to sustain competitive advantage in a dynamic environment. This research should focus on providing improved explanations of new firm growth by analysing process events (problems, innovation) and learning (entrepreneurial, organizational; inter-organizational) during the life course.

⁶ This is not to say that there are invariant stages of growth (Greiner 1972).

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Appendix

<i>Authors</i>	<i>Time period</i>	<i>Industries</i>	<i>Number of firms</i>	<i>Region</i>
Cooper et al. 1994	1985-1987 (3 years)	Representative for new firm population	1 053	US
Dahlqvist et al. 2000	1994-1997 (3 years)	All except agriculture, forestry, hunting, fishery, and real estate	6 377	Sweden
Schutjens and Wever 2000	1994-1997 (3 years)	All except agriculture and mining	563	Netherlands
Bosma et al. 2004	1994-1997 (3 years)	All except agriculture and mining	758	Netherlands
Vivarelli & Audretsch 1998	1985-1993 (<9 years; mean age 3 years)	All	100	Emilia (Italy)
Colombo & Grilli 2005	1980 (or later)–2004 (max. 13 years)	High tech sectors (computers, electronic components, telecommunication equipment, optical, medical, and electronic instruments, biotechnology, pharmaceuticals, advanced materials, robotics, and process automation equipment, multimedia content, software, internet services, and telecommunication services)	506	Italy
Almus & Nerlinger 1999	1992/1996-1998	Manufacturing industries (both 'High-Tech Industries' (R&D-intensity above 3.5%) and 'Non-High-Tech Industries' (R&D-intensity below 3.5%).	8 739	Germany
Brüderl & Preisendörfer 1998	1985/86-1990 (4 years)	All except crafts, agriculture, physicians, architects, and lawyers	1 710	Munich and Upper Bavaria (Germany)

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