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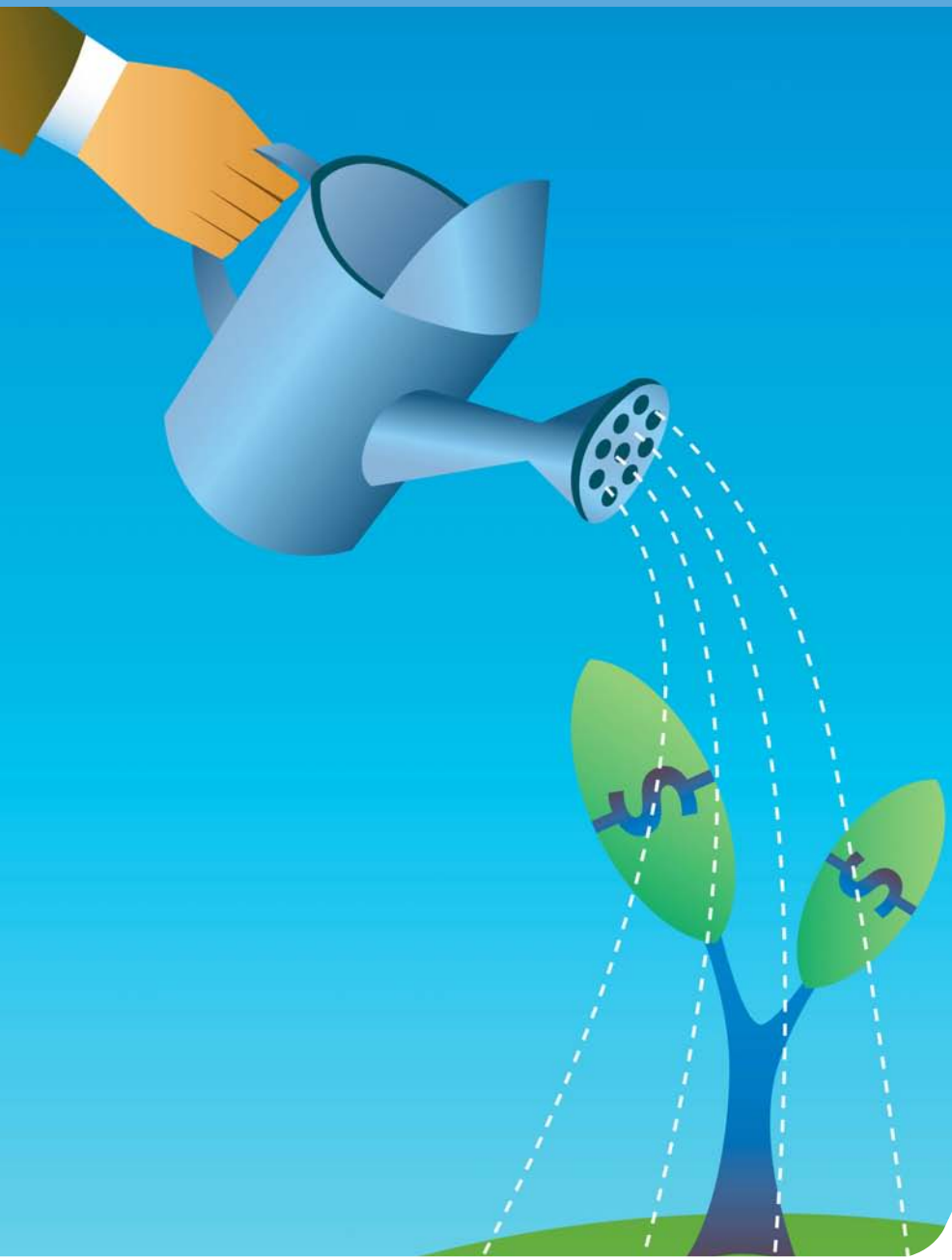

Olavi Lehtoranta

Knowledge flows from incumbent firms to newcomers

The growth performance of innovative SMEs and services start-ups

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Title

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Abstract

The aim of this study is to analyse the knowledge flows from incumbent firms to newcomers in technology and knowledge-based industries. The focus is on the following questions: to what extent does knowledge embodied in labour flows create innovative and successful business activities, especially in services? What kinds of knowledge are flowing into start-ups and where are they originating? The second type of questions is related to the growth effect of spin-offs: do spin-offs grow faster than other start-ups, and do start-ups with job-changers grow faster than other start-ups?

We found that the expertise accumulated in the previous workplace has a real effect on the growth of start-ups as well as spin-offs. The growth process of spin-offs, however, differs from that of other start-ups. In addition, spin-offs will reach the high growth phase more often than similar non-spin-offs. Counterparts for the known spin-offs are chosen by using the propensity score matching technique, where the matched groups of firms have approximately the same joint probability distributions in terms of the likelihood to apply for patents, to receive public R&D funding as well of belonging to the same cohort, technology field and the size class of the firms.

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Preface

This report summarizes the results of the research project “Knowledge flows from incumbent firms to newcomers: The success of new innovative businesses in manufacturing and services.” carried out with funding from Tekes (Finnish Funding Agency for Technology and Innovation). This study is an extension to the research project “From Innovation to Sustainable Competitive Advantage” where the flows of innovations and technological knowledge from large companies to their spin-offs were analysed. This study also examines the knowledge flows from small firms and service firms to new start-ups.

This work is carried out in collaboration with M.Sc. (Eng.) Pasi Kuusela from Helsinki University of Technology and Dr. Annaleena Parhankangas from New York Institute of Technology, USA. Dr. Bernd Ebersberger from Management Center Innsbruck, Austria has provided his kind assistance in using and even in improving the propensity score matching algorithm. My warm acknowledgements go to all these collaborators, and to the whole steering group. The results and conclusions of this report are, however, drawn only by the author and the collaborators are not liable for them.

Espoo, June 2010

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Contents

1. Introduction

The aim of this study is to analyse the knowledge flows from incumbent firms to newcomers in technology and knowledge-based industries. The focus is on the following questions: to what extent does knowledge embodied in labour flows create innovative and successful business activities, especially in services? What kinds of knowledge are flowing into start-ups and where are they originating?

This study is an extension of the research project "From Innovation to Sustainable Competitive Advantage" carried out with the funding from Tekes (the Finnish Funding Agency for Technology and Innovation). This project has analysed the flows of innovations and technological knowledge from large companies to their spin-offs, the innovativeness and growth performance of Finnish firms in manufacturing and in the knowledge-intensive business services (KIBS) sectors, and the role of market learning, assets and collaboration in the success of product innovations (Kuusela 2006; Danielsen 2006; Lehtoranta 2010). This study also examines the knowledge flows from small firms and service firms to new start-ups.

The focus here is on the education and skills of personnel who move from incumbent firms to spin-offs and other start-ups. We examine to what extent these labour flows create innovative business activities among start-ups. Research findings on this topic are contradictory. According to the population ecology school, the knowledge flows from incumbent firms reduce the willingness to renew, innovate, replicate or multiply outdated practices; evolutionary economics, in contrast, perceives the knowledge flows as resources that encourage start-ups to succeed and innovate.

The enlargement of the previous study can be justified by the fact that more spin-offs are born in business services than in technology-based industries and that small firms are remarkable incubators for new innovative businesses. The dynamics of knowledge flows from large firms are also different from those of small service firms. The spin-offs of large firms are mainly divestments of business activities outside the core business (spin-offs motivated by restructuring), whereas the spin-offs of small companies and service firms are born from the will of a person/persons to enter into business (entrepreneurial spin-offs).

This study was carried out simultaneously with the studies of Kuusela (2006). In these studies, corporate spin-offs were identified and surveys were conducted among the ser-

vice firms and among the spin-offs and their parents. First, the group of potential spin-offs was identified by using the information on the mobility of personnel between organisations based on the employer-employee data. This basic identification of spin-offs was done at Statistics Finland. Then real spin-offs were verified in this group of potential spin-offs with firm-specific surveys and interviews. This second identification was done at the Helsinki University of Technology.

The study in question was conducted at Statistics Finland by using statistical and econometric methodologies applied to several statistical data sets; the spin-offs and their parents were verified in Kuusela (2006). The information on the innovativeness of firms is based on the R&D and CIS Surveys and on the Database of Finnish Innovations (Sfinno). The flows and skills of the personnel can be traced annually after the birth of a firm from the employer-employee data. In contrast to Kuusela (2006), somewhat broader and cruder data on all start-ups were used in this study, e.g. data obtained from the Business Register, the Patent Register and the Employer-Employee Register. We have, however, attempted to make our results statistically more representative among SMEs and service start-ups.

In addition to all start-ups, the research groups consist of all 335 corporate spin-offs verified by Kuusela (2006). The growth of firms is measured in terms of turnover and employment, and the innovativeness of firms with their R&D and innovation activities. Target groups include all technology firms and knowledge-intensive business services (KIBS) firms that have been established since the mid-1990s in Finland.[1]

This report is organised as follows. Corporate spin-offs are defined in Chapter 2. Chapter 3 gives a short literature review on spin-offs, with research mainly based on the publicly available data on firms, detailed surveys and interviews. In contrast, the main data source in our study consists of statistical micro data and administrative registers. In Chapter 4, these datasets and research targets are described in more detail. Chapter 5 presents an econometric analysis on factors affecting the growth of spin-offs and start-ups. The question is whether spin-offs grow faster than other start-ups, whether start-ups with incoming labour flows grow faster than other start-ups (greenfield firms) and what the corresponding results are for innovative spin-offs and start-ups. Do the characteristics of the parents affect the growth and innovation performance of spin-offs? In Chapter 6, the knowledge flows from incumbent firms to spin-offs and to other start-ups are examined, along with the question of what kinds of knowledge have entered high-growth firms, which are referred to as gazelles. The summary and conclusion are then presented in Chapter 7.

[1] The target sectors in this study are manufacturing, IT services, R&D services and other business services.

2. The definition of corporate spin-offs

A corporate spin-off is usually defined as follows: “A corporate spin-off is the division of an existing company into one parent company and one or more independent spin-offs. The spin-off unit constitutes the basis for the operation of an economic activity that is often new.” (Tübke 2005; Lindholm 1994). In this study, the independence of spin-offs is defined in a bit more detail: if the share of ownership of the parent company or any other company in the spin-off, except for a venture capital company, is less than 50 percent, then the spin-off is regarded as independent. It follows that so-called latent spin-off firms (Tübke 2005) are excluded.

This definition does not cover entrepreneurial spin-offs, in which an entrepreneur decides to establish a new company on the basis of an innovation or an idea reached e.g. in IT consulting. These kinds of business start-ups are also regarded as spin-offs here. We do not set any precondition on how knowledge is applied in a new economic activity. So-called hostile spin-offs, which start to compete with the parent, are also included. A spin-off firm is here defined to be an independent firm with a founder who has already worked for another organisation (see e.g. Roberts and Wainer 1968; Roberts 1991; Elfring and Foss 1997). In order for a start-up to be considered a spin-off, many studies require that the establishment of this start-up also comprises the transfer of some rights, assets or knowledge from the incumbent organisation to the start-up. A spin-off firm can also be defined so that it only comprises the transfer of the general management skills of the founders. The business idea of a spin-off does not have to be engaged with its parent’s markets or technical knowledge (Kuusela et. al. 2008).

In principle, all independent subsidiaries are spin-off firms. They are often already in the spin-off process and the parent company may assign control to the subsidiaries in the future. On the other hand, entrepreneurial spin-offs are the focus if the targets are new business activities emerging from incumbent firms. The question of the collaboration between an entrepreneurial spin-off and its parent is important, as is the question of how the spin-off has been established (together with the parent or against the parent’s will).

3. Spin-offs as research targets

In today's knowledge and innovation-driven society, knowledge and learning are key factors that boost the competitiveness and growth of the economy. Spin-off firms play an important role in transferring knowledge and technology from one organisation to another. They are also regarded as important in the renovation of industrial structures, because they will either produce new business activities or replace old contracting or expiring activities. Spin-offs are important when they create new dynamic business firms, and also when they create leaner, more competitive and focused businesses. Entrepreneurial spin-offs are both the consequences and the drivers of economic renewal. They comprise an important source of entrepreneurship and innovation (see e.g. Roberts 1991; Agarwal et al. 2004) when they are focused on exploiting inventions and making them more user-friendly. According to empirical observations, they also survive longer and grow faster than other start-ups. Among others, Delmar et al. (2003); Lindholm (1994) and Lindholm-Dahlstrand (1997) have shown that entrepreneurial spin-offs emerging from new technology-based firms (NTBFs) have an important role in commercialising innovations and increasing employment.

The targets of policy measures have mainly been institutional spin-offs, for example new research-based firms that have been established for the commercial utilisation of research results. Policy makers and researchers, however, are also interested in entrepreneurial spin-offs that efficiently utilise the knowledge and competence gained by the parent firm. An entrepreneurial spin-off is managed by one or more entrepreneurs, the motive of which is to take advantage of unused potential of the parent company. Spin-offs do not necessarily receive any aid from the parent organisation. Compared to the university spin-offs, entrepreneurial corporate spin-offs are often more innovative and more focused on the use of inventions. Due to their weaker market position and a smaller number of customers, they do not reach the same level of performance as their parents. They do, however, have on important effect on e.g. regional structures.

Firms continuously change their structures and search for new organisational arrangements. It has been observed that more spin-off firms are established during years when M&A activity[2] is high. There are also indications that parents with high growth are more likely to enter the spin-off process if they themselves are not able to take advantage of the opportunities of spin-off firms. The transfer from the parent has many dimensions, like specific content, and the intensity and manifestation in technology and personnel resources. Support from the parent can be high in the beginning but generally decrease three to five years after the start. At the same time, independence increases. In the beginning, the parent is sometimes the most important client for the spin-off (Nås et al. 2003). Parhankangas (1999) observed the positive relationship between the technological complementarities of the parent and the spin-off team before the separation and the growth of spin-off firm after the separation. Nonetheless, little has been written on the role of circumstances in the birth of spin-offs and on the relationships between parents and spin-offs.

Corporate spin-offs are difficult to identify from the enterprise population. In Finland, the last time an attempt was made to identify corporate spin-offs in the manufacturing and knowledge-intensive service sectors was in 2003. In that project, financed by the Nordic Innovation Centre (NICe), a Nordic comparison of high-tech spin-offs was carried out (Nås et al. 2003). This study also involved the tracking of spin-offs and their parents based on the Business and Establishment Register and the Employer-Employee Register. Here, all new business and establishment identification numbers (IDs) and labour mobility from one organisation to another were used as references.

In the study mentioned above, the number of potential (non-verified) spin-offs in manufacturing and knowledge-intensive services in 2000 was found to be 600 in Finland, 850 in Denmark, almost 900 in Norway and 1700 in Sweden. The number of high-tech spin-offs was respectively 115, 166, 135 and 311. Although these numbers are crude, they are indicative of the total annual number of spin-offs. In Kuusela (2006), about 400 corporate spin-offs in technology fields were successfully verified from 1996–2004 in Finland, based on enterprise surveys, interviews and Internet home pages.[3]

The study by Nås et al. (2003) found that it was more likely for the growth of spin-offs (i.e. potential spin-offs) to be higher than that of other start-ups during the first five

[2] Mergers and acquisitions.

[3] Register-based identification produces approximately 1,200–1,500 start-ups with job-changers annually in manufacturing, IT services, R&D services and other business services depending on the criteria used. As expected, we found that the highest number of start-ups with job-changers comes from firms which continue their operation and from which a minority of the employees moves to a start-up (starting code 8). In manufacturing, the real spin-offs of large companies were verified with surveys and interviews. In services, the attention was also focused on the spin-offs of small companies and on one-person inflows.

years. In addition, spin-offs had a clearly higher survival rate than other start-ups. The spin-offs in Finland and in Denmark performed clearly better in employment growth than other start-ups in these countries. These findings reflect the fact that the working experience and networks created by the founder and other employees are important to the performance of the start-up (see e.g. Klepper and Sleeper 2005).

Nevertheless, it proved difficult to explain this improved performance. In the study by Nås et al. (2003), the regressors, except for the origin of the firm, had no explanatory power. The probit (and logistic) models included the following regressors: the number of employees in the starting year, the origin of the firm (spin-off, non-spin-off), industries by technology classes, the share of highly educated employees and the average age of the employees in the starting year. The share of highly educated employees had no significant effect on the growth of start-ups (classified as growing or non-growing over the first five years) in any of the Nordic countries. The characteristics of spin-off teams also had no impact on the performance of spin-offs. One reason for this may be that more extensive background information on the spin-off teams was not available. In addition, there was no information on whether the parent organisation was a multi-unit organisation, or about regional and competitive conditions. Nås et al. pointed out that the improved performance of spin-offs as compared to other start-ups weakens fast over the years, and that only a single cohort was involved in the analysis.

4. Research data

The whole population of Finnish enterprises includes 133,271 firms that have been established between 1994 and 2004. Of these, 74,817 firms belong to industries within the scope of this study, while 29,746 are limited companies. Because part of the start-ups are so-called “large start-ups” (mainly indicating changes in business IDs and not real start-ups), we narrowed the study down to limited companies with less than 50 employees when starting. This way, we ended up with a set of research data that includes 21,666 start-ups. On average, these firms had two people when they were founded.

Here, the innovativeness of start-ups is defined according to their R&D activities, patenting activities and customership of Tekes. If a firm has in-house R&D expenditures, purchased R&D, working hours used for R&D, R&D funding from Tekes or has filed patent applications, it is defined as “innovation-active”. In addition, it is defined to be innovative if it has commercialised a product innovation according to the Database of Finnish Innovations (Sfinno) maintained by VTT. Data from the Community Innovation Surveys (CIS) are not used here, because they usually refer only to enterprises with more than 10 employees.

Of the 21,666 start-ups concerned in this study, 2,084 firms, almost 10 percent, were innovation-active in the period 1994–2004. Meanwhile, 2,364 of the firms were high-growth firms (gazelles), based on an average annual growth in turnover of more than 20 percent for three or more years in a row. The figures on annual turnover were taken from the Business Register. Among the gazelles, 441 firms, about 20 percent, were known to have performed innovation activities. The number of innovative gazelles was especially high in IT services and in other business services, where two-thirds of all start-ups in the manufacturing and in the knowledge-intensive business services are located. The highest proportion of innovative firms was in the field of research and development.

Among the start-ups, we identified 335 firms with less than 50 employees that were corporate spin-offs. Some of these are spin-offs of large companies and other of small companies. The number of spin-offs among gazelles was 65, of which 29, about 45 percent, conducted innovation activities. The highest number of innovation-active gazelles

was in IT services. Of the 2,084 innovative start-ups, 103, about 5 percent, were found to be spin-off firms. Among the 441 innovative gazelles, there were 28 spin-offs (about 7 percent).

Of the 335 spin-offs, there were 103 firms (about 30 percent), that could be categorised as innovation-active according to our criteria. Based on their principal industrial activity listed in the Business Register, 100 of these belonged to knowledge-intensive services. In absolute terms, the highest figures of spin-offs can be found in the industries 72.2 (software consultancy and supply), 74.1 (legal, business and management consultancy) and 74.2 (technical consultancy). Among innovative spin-offs, there were 10 firms in the fields of high technology and 3 firms in the fields of low technology. About one-third of innovative spin-offs were gazelles. Half experienced an average growth in turnover of more than 20 percent during their first three years. Among one-third of the firms, the average annual growth in employment was higher than 20 percent in the same period.

Table 1. The number of spin-offs by technology field and size of parent.

Sector Size of parent	High technology	Low technology	Knowledge intensive services	Total
Large parent	18	13	28	59
Small parent	15	0	261	276
Total	33	13	289	335

Next we tracked labour inflows among all business start-ups from all other enterprises, other organisations and from outside the labour force for each two-year period since 1988. We used information on the number of persons who changed jobs by education and their area of study in classes: primary, secondary, tertiary and post-graduate education in technical, commercial and other fields. We also utilised information on the average age of these persons between two consecutive years and about the year they started their previous job. Corresponding annual information for all the personnel as well as on the characteristics of the firms and their patent applications are also available here. These data are available for all start-ups from the year 1994 onwards. For some firms, mobility flows can be found from the year 1988 onwards.

Table 2. The number of spin-offs by technology field and industry.

Sector Industry	High technology	Low technology	Knowledge intensive services	Total
21	0	1	0	1
22	0	2	0	2
24	1	0	0	1
25	0	1	0	1
26	0	2	0	2
27	0	1	0	1
28	0	6	0	6
29	24	0	0	24
31	1	0	0	1
32	3	0	0	3
33	4	0	0	4
72	0	0	129	129
73	0	0	9	9
74	0	0	151	151
Total	33	13	289	335

By linking these data with the classification of whether or not a firm was a real spin-off, we were able to conduct a controlled analysis of the differences between spin-offs and non-spin-offs, also within the subgroup of innovative firms. For the control group, we selected all similar non-spin-offs among start-ups. We also compared spin-offs with all other start-ups at the group-level. Our interest was also focused on the following question: which groups of start-ups (with starting codes 2, 4, 6 or 8, referring to whether the parent firm survives or not and whether a majority or minority of the employees moves to a start-up) had the highest number of potential spin-offs? Our main attention, however, was directed to the mobility flows towards verified spin-offs, starting with the flows from all organisations and ending with the flows from verified parents. In this study, the following variables were used to describe the growth of firms:

turn_growth average annual sales growth of a firm over its first three years
emp_growth average annual employment growth of a firm over its first three years
turn_01 binary variable indicating that turn_growth is more than 10 percent
turn_02 binary variable indicating that turn_growth is more than 20 percent
emp_01 binary variable indicating that emp_growth is more than 10 percent
emp_02 binary variable indicating that emp_growth is more than 20 percent
turn_hg binary variable describing whether the average annual growth in sales of a firm is more than 20 percent for any three year period
gs, ge the starting and ending years for the high growth period
avg_growth average annual sales growth rate of a firm during its high growth period

5. Factors affecting the growth of start-ups

In this chapter, we consider the characteristics of start-ups and analyse whether these characteristics – and especially, the origin of start-ups (spin-off or not) – explain their growth performance. First of all, we focus on the question of which factors explain the high growth of innovative start-ups in terms of turnover and number of personnel in knowledge-intensive business services and among small start-ups.

We explain whether or not high growth is achieved using a probit model and by controlling certain characteristics of spin-offs. In order to reveal the spin-off effect, we distinguish the characteristics which spin-offs may share with non-spin-offs. However, we are not able to eliminate the potential survival bias. This bias may emerge because only the origin of surviving start-ups can be investigated. It follows from this bias that older cohorts of start-ups may have more surviving (and therefore, more successful) firms than younger cohorts of start-ups, in which survival and high growth can be observed, for example, after the research period. This can, for its part, result in the starting year having a biased negative impact on the growth of firms, meaning that younger generations of firms seem to grow slower and include fewer gazelles than older generations.

In order to control the sample selection, we search all start-ups (and all real non-spin-offs) within the industries of this study for a counterpart to each of the spin-offs. These counterparts comprise the control group for the spin-offs. The way in which the firm origin affects the growth of start-ups can be revealed by comparing the performance of spin-offs to that of their counterparts in their early years. When searching for counterparts, we use certain observed characteristics of spin-offs, namely their technology field, size, patenting activities, public R&D funding and starting year. These data exist for all start-ups.

In this study, corporate spin-offs have only been identified among certain technology and service fields. These industries should, therefore, be controlled for when analysing the spin-offs. When estimating the spin-off effect, it is not necessary to control for the characteristics of spin-offs and their counterparts directly. In certain cases, it suffices to check to what extent the counterparts are similar to their observed spin-offs in terms of their joint probability distributions. The similarity in the characteristics of start-ups can

therefore be measured by determining how likely it is that their characteristics are similar to those of spin-offs. This technique is called the propensity score matching technique.

5.1 Characteristics of corporate spin-offs

In the following analysis, the origin (spin-off or not) of the start-ups are explained with a probit model in order to see which characteristics are most common among spin-offs. As regressors, we use not only the industry (technology field) but also the size of the firms, their goals in terms of developing innovations and technologies measured by their patenting activities, their public R&D funding and their starting year. We control for the innovativeness of the start-ups because we believe that it affects the performance of firms and because our next focus is on innovation-active start-ups. We restrict our analysis mainly to start-ups with less than 50 employees in their third year, i.e. in year $t = 2$, when the starting year is $t = 0$.

The results of the probit model show that statistically, the identified spin-offs are significantly larger than other similar start-ups in year $t = 2$. In addition, the share of graduates and employees with technical education is higher in spin-offs than in other start-ups and they are more likely to get public R&D funding than other start-ups. Spin-offs were found more often towards the end of the period 1994–2004. The average starting year of spin-offs is 1997. None of these characteristics, however, were used as a criterion in identifying firms as spin-offs.

To clarify, the following explanatory variables were used in the probit model as the characteristics of spin-offs: the technology field of the firm (sector dummy); the size of the firm measured as the logarithm of the number of employees in year $t = 2$; the dummy describing the patenting activity of the firm within its first three years; the dummy describing the access to public R&D funding near to the starting year, and a starting year within the period 1994–2004, scaled to the interval 1–11. These variables were used because they represent the most comprehensive data available. Patenting and public R&D funding are used to describe the firm's focus on the development of innovations and technologies.

Table 3. Factors characterising spin-offs among all start-ups (probit model).

Dependent variable Spin-off	Coef.	Std. Err.
Sectors	included	
Number of employees (log)	0,148***	0,025
Applies for patent	-0,151	0,156
Share of graduates	0,180**	0,076
Share of technical education	0,402**	0,184
Public R&D funding	0,432***	0,077
Starting year	0,110***	0,011
Constant	0,881	0,192
Number of observations	10 552	
LR chi2(11)	344,1	
R2	0,132	
LL	-1134,8	

*** (**,*) indicates significance at the 1%, (5%, 10%) level.

Table 4. The average size, share of graduates and share of employees with technical education in spin-offs and in other start-ups over their first three years.

Average	N of empl.	Share of graduates	Share of tech education	Turnover per capita 1 000 €
Spin-off firms	7,5	50,7 %	5,8 %	94
N	335	284	284	335
Other start-ups	3,4	36,6 %	2,0 %	113
N	21,666	10,276	10,276	21,251

It is good to note that large divestments (however, with less than 50 employees) as well as small service firms are included in the identified spin-offs. Their characteristics (sectors, size et al.) have to be taken into account when estimating the growth effect of spin-off origin. The average growth of spin-offs and other start-ups (in manufacturing, IT services, R&D services and other business services) are shown in Table 5. Here we can see that the growth of spin-offs in terms of both sales and employment are clearly higher than those of other start-ups within their first three years.

Table 5. The average annual growth in employment and turnover among spin-offs and other start-ups over their first three years.

Average	Before matching Growth in employment	Growth in turnover	After matching Growth in employment	Growth in turnover
Spin-off firms	8,5 %	14,5%	8,5 %	14,5 %
N	330	330	330	330
Other start-ups	2,7%	6,8 %	5,6 %	9,6 %
N	20,707	20,707	330	330

5.2 Factors affecting the high growth of start-ups

In this chapter, the determinants of the high-growth start-ups (gazelles) will be analysed. As mentioned before, we make a distinction between spin-off effects and other effects related to characteristics that may be common to spin-offs as well as non-spin-offs. The determinants explaining high growth are estimated with a simple probit model in the whole sample of start-ups (N = 10,552). Here, "high growth" means that the average annual sales growth of a start-up exceeds 20 percent for three years in a row. This period can deviate somewhat from the three first years, depending on the number of observed surviving years for a start-up, for example.

The results show that the starting size, business origin (spin-off or not), R&D activities and public R&D funding all have a highly significant positive impact on the likelihood that a start-up will be a high-growth firm.

In the matched sample (N = 517), the spin-off origin also makes it much more likely that it will be a gazelle. The binary variable of the spin-off origin captures the effect of the unobserved growth determinants, like the management skills, experience and networks created in the previous jobs of personnel. This effect is, at least partly, independent of the effect of observed characteristics of start-ups like the share of highly educated personnel.

Whether the start-up will turn out to be a gazelle depends greatly on the number of employees: the larger the starting size, the more likely the start-up will become a gazelle. The starting year itself has a negative impact on whether a start-up turns out to be a gazelle: start-ups that began their operations towards the end of the research period 1994–2004 were less likely to become gazelles than start-ups that started at the beginning of the period. Results also show that start-ups with relatively younger people attained higher growth than start-ups with older personnel. However, this result does not hold in the matched samples where sectors (technology fields), starting years, the size of the firms and their goals in developing innovations and technologies measured by their patenting activities and access to public R&D funding are matched.

Table 6. Factors characterising high-growth firms among all start-ups (probit model).

Dependent variable	Before matching		After matching	
High growth firm	Coef.	Std. Err.	Coef.	Std. Err.
Sectors ^	included		included	
Number of employees (log) ^	0,090***	0,015	0,178**	0,073
Spin-off	0,269***	0,091	0,334**	0,139
Performes R&D activities	0,232***	0,082	0,019	0,357
Share of graduates	0,055	0,044	0,084	0,215
Share of technical education	-0,070	0,149	-0,275	0,530
Public R&D funding ^	0,241***	0,091	0,227	0,371
Average age of employees	-0,162***	0,002	-0,015	0,011
Starting year ^	-0,081***	0,006	-0,083***	0,032
Constant	4,525	0,125	-0,379	0,587
Number of observations	10 552		517	
LR chi2(13)(11)	425,5		30,98	
R2	0,050		0,066	
LL	-4027,1		-218,8	

*** (**,*) indicates significance at the 1%, (5%, 10%) level.

^ these factors and patenting are used in matching

We can further observe that in the full sample of start-ups, the average annual sales growth of spin-offs exceeds 10 percent more often than that of other similar start-ups within their first three years. But what is most interesting is that the growth of spin-offs is only higher than the growth of other start-ups within the first three years.

5.3 Characteristics of innovative spin-offs

When the focus is only limited to innovation-active start-ups (N = 1,206, Table 7), we can see that there is no significant distinction between spin-offs and other start-ups in terms of the share of employees with technical education. The average share of employees with technical education varies from 6 to 7 percent in both groups. These groups are composed mainly of knowledge-intensive service firms. Here too, the growth of innovative spin-offs is clearly higher than that of other innovative start-ups within their first three years.

Table 7. Factors characterising spin-offs among innovative start-ups (probit model).

Dependent variable Spin-off	Coef.	Std. Err.
Sectors	included	
Number of employees (log)	0,216***	0,058
Applies for patent	-0,163	0,163
Share of graduates	0,490**	0,198
Share of technical education	-0,135	0,366
Public R&D funding	0,334**	0,151
Starting year	0,118***	0,024
Constant	-3,412***	0,426
Number of observations	1206	
LR chi2(9)	69,3	
R2	0,113	
LL	-272,7	

*** (**,*) indicates significance at the 1%, (5%, 10%) level.

Table 8. The average size, share of graduates and share of employees with technical education among innovative spin-offs and other start-ups over their first three years.

Average	N of empl.	Share of graduates	Share of tech education	Turnover per capita 1 000 €
Spin-off firms	9,6	60,7 %	7,6 %	84
N	103	85	85	103
Other start-ups	7,3	47,6 %	5,5 %	88
N	1,981	1,234	1,234	1,973

Table 9. The average annual growth in employment and turnover among innovative spin-offs and other start-ups over their first three years.

Average	Before matching Growth in employment	Growth in turnover	After matching Growth in employment	Growth in turnover
Spin-off firms	12,0 %	20,7 %	12,0 %	20,7 %
N	100	100	100	100
Other start-ups	6,6%	14,8%	7,0 %	16,9 %
N	1,858	1,858	99	99

5.4 Factors affecting the high growth of innovative start-ups

The business origin (spin-off or not) and public R&D funding are also significant determinants of high growth in the group of innovation-active start-ups. As in the full sample of start-ups, the more recent the starting year the less likely the start-up will turn out to be a gazelle in the group of innovative start-ups: the later the starting year from year 2000, the slower the average growth of the start-ups over their first years. This is also related to the drop in the total number of gazelles after the millennium and can be partly attributed to the IT boom at the turn of the century.

The average age of the personnel in year t = 1, when the firm starts in year t = 0, also has a negative impact on the growth of the firm in its early years. Start-ups in which the average age of personnel is high grow more slowly during their early years than start-ups with younger personnel. The reason for this may lie in different business strategies or in risk aversion due to age.

Table 10. Factors characterising high-growth firms among innovative start-ups (probit model).

Dependent variable	Before matching		After matching	
High growth firm	Coef.	Std. Err.	Coef.	Std. Err.
Sectors ^	included		included	
Number of employees (log) ^	0,013	0,035	0,458***	0,152
Spin-off	0,289*	0,159	0,566**	0,264
Share of graduates	-0,066	0,125	-0,205	0,508
Share of technical education	-0,048	0,252	-1,303	1,018
Public R&D funding ^	0,220**	0,090	0,329	0,401
Average age of employees	-0,024***	0,006	-0,056**	0,028
Starting year ^	-0,116***	0,016	-0,246***	0,061
Constant	0,126	0,277	2,360	1,462
Number of observations	1318		162	
LR chi2(11)(10)	90,7		41,1	
R2	0,061		0,233	
LL	-696,3		-67,7	

*** (**,*) indicates significance at the 1%, (5%, 10%) level.

^ these factors and patenting are used in matching

5.5 Spin-offs versus non-spin-offs

The starting size of verified spin-offs and non-spin-offs is about 5 persons and there are no significant differences between their average sales growths over the three first years. However, in the matched group (N = 660), where the number of both spin-offs and similar non-spin-offs is 330, spin-offs turn out to be high-growth firms more often than non-spin-offs. In the matched group, the share of personnel with technical education is smaller in spin-offs. Here too, public R&D funding contributes positively to the growth of the start-ups.

The matched group of innovative start-ups includes 103 spin-offs and 103 similar non-spin-offs. The average growth in sales and employment over the three first years is higher among non-spin-offs, as well as the share of personnel with technical education. In contrast, the level of productivity is higher among spin-offs. Otherwise, the characteristics of innovative spin-offs and innovative non-spin-offs are highly similar. An interesting finding concerning innovative start-ups is that the interaction between technical and commercial education contributes positively and highly significantly to the growth of the start-ups.

5.6 Characteristics of start-ups with job-changers

In this study, we found that start-ups with persons entering from incumbent organisations are largely affected by the same factors that characterise the verified spin-offs. Their size and share of graduated employees is higher, and they are more likely to receive public R&D funding than other start-ups. The share of start-ups with job-changers is higher towards the end of the period 1994–2004. It follows from these observations that we refer to these start-ups as potential spin-offs (Table 11).

Table 11. Factors characterising start-ups with job-changers among all start-ups (probit model).

Dependent variable Start-up with job-changers	Coef.	Std. Err.
Sectors	included	
Number of employees (log)	0,204***	0,012
Applies for patent	0,108	0,087
Share of graduates	0,189***	0,034
Share of technical education	0,195*	0,115
Public R&D funding	0,157***	0,046
Starting year	0,029***	0,005
Constant	-6,704***	0,091
Number of observations	10 552	
LR chi2(11)	502,7	
R2	0,035	
LL	-6843,4	

*** (**,*) indicates significance at the 1%, (5%, 10%) level.

The total number of potential spin-offs was 4,839 of the 21,666 start-ups in Finland. Finding matched pairs in terms of sector, size, cohort and developing innovations and technologies from the group of other start-ups for such a numerous quantity of potential spin-offs was not successful. However, for potential innovative spin-offs (N = 793) we found equal number of counterparts among other innovative start-ups. In the matched data set (N = 1,318) a large starting size, a high share of employees with technical education and higher access to public R&D funding characterise the potential spinoffs (Table 12).

Table 12. Factors characterising start-ups with job-changers among innovative start-ups (probit model).

Dependent variable Start-up with job-changers	Coef.	Std. Err.
Sectors	included	
Number of employees (log)	0,214***	0,031
Applies for patent	0,152	0,093
Share of graduates	0,160	0,108
Share of technical education	0,523**	0,229
Public R&D funding	0,153*	0,079
Starting year	0,002	0,013
Constant	-0,848***	0,154
Number of observations	1 318	
LR chi2(10)	80,3	
R2	0,044	
LL	-873,4	

*** (**,*) indicates significance at the 1%, (5%, 10%) level.

5.7 Firm origin as a determinant of high growth

Even though this part of the study involves modelling the high growth of innovative start-ups with job-changers (referred as potential spin-offs) as opposed to verified spin-offs, the results are the same as those obtained for spin-offs. The probit model yields the same statistically significant growth determinants as those obtained earlier: potential innovative spin-offs are more likely to be gazelles than other innovative start-ups. Apart from the observed characteristics of start-ups, firm origin (potential spin-off or not) also affects the growth of start-ups. This is clear evidence that the knowledge and expertise accumulated by personnel in their previous workplace has a high impact on the growth of a start-up, no matter how this experience is channelled in the start-up, i.e. through the founder or through other recruits in the early years of the start-up.4

[4] Business registers are usually not able to identify the founder or founders of a start-up.

Table 13. Factors characterising high-growth firms among innovative start-ups (probit model).

Dependent variable	Before matching		After matching	
High growth firm	Coef.	Std. Err.	Coef.	Std. Err.
Sectors ^	included		included	
Number of employees (log) ^	0,009	0,036	-0,003	0,040
Start-up with job-changers	0,158**	0,080	0,162**	0,082
Performes R&D activities	-0,246	0,243	-0,332	0,311
Share of graduates	-0,071	0,125	0,115	0,135
Share of technical education	-0,080	0,254	-0,219	0,261
Public R&D funding ^	0,248***	0,094	0,211**	0,103
Average age of employees	-0,023***	0,006	-0,029***	0,007
Starting year ^	-0,113***	0,015	-0,104***	0,016
Constant	0,255	0,348	0,742	0,423
Number of observations	1 318		1 199	
LR chi2(12)	92,4		76,4	
R2	0,063		0,056	
LL	-695,5		-646,0	

*** (**,*) indicates significance at the 1%, (5%, 10%) level.

^ these factors and patenting are used in matching

6. Knowledge flows to newcomers

In this chapter, we delve into the kind of knowledge that moved into spin-offs, where the knowledge came from, and what kind of knowledge moved both in and out of gazelles. In this analysis, we used the 335 spin-offs verified by Kuusela (2006). In the starting year (or in the following year), 2,935 persons moved into these spin-offs. We found that 239 persons came from the verified parents and 2,696 from other organisations. These organisations together with the verified parents are referred to here as parent organisations, and their characteristics are examined in the starting year or close to it.

We found 1,917 parent organisations among spin-offs, including research institutes and universities. Of these, 210 were verified parents, though only 75 of these were different organisations. On average, 2 to 3 spin-offs spanned from a parent and the number of moved persons per organisation was 1.5. The share of parent organisations and moved persons by size classes of organisations is presented in Table 14. About 60 percent of the parent organisations had less than 50 employees. From these small and medium-size organisations, 1,553 persons moved into spin-offs, 53 percent of all employees who moved. These organisations correspond to many industries, though they mainly formed part of the same industries as the spin-offs. The highest share of parents are in industries 74 (other business services), 72 (IT services), 51 (wholesale), 52 (retail sale) and 29 (engineering).

The percentage of highly educated (HE) employees was 53% and the percentage of employees with technical education was 43% among the job-changers that moved into small spin-offs. The corresponding figures for large spin-offs were 32 and 53%. Large spin-offs are more likely to recruit job-changers with a technical education. The majority of job-changers coming into large spin-offs are employees with primary or secondary education. The majority of job-changers who join small spin-offs have an academic degree.

Table 14. The parent organisations of spin-offs and the job-changers who move from them into spin-offs by size class and the level and field of education.

Size class	Organisations		Job-changers		Of which graduates		Of which employees with technical education	
	N	%	N	%	N	%	N	%
0-5	361	18,8	451	15,4	144	31,9	194	43,0
5-10	225	11,7	313	10,7	127	40,6	140	44,7
10-20	258	13,5	341	11,6	167	49,0	129	37,8
20-50	319	16,6	448	15,3	231	51,6	225	50,2
50-100	204	10,6	347	11,8	150	43,2	168	48,4
100-250	209	10,9	284	9,7	139	48,9	133	46,8
250-500	133	6,9	333	11,3	100	30,0	203	61,0
500-1000	106	5,5	290	9,9	83	28,6	180	62,1
1000-	102	5,3	128	4,4	61	47,7	60	46,9
Total	1917	100,0	2935	100,0	1202	41,0	1432	48,8

Table 15. The verified parents of spin-offs and the job-changers who move from them into spin-offs by size class and the level and field of education.

Size class	Organisations		Job-changers		Of which graduates		Of which employees with technical education	
	N	%	N	%	N	%	N	%
0-5	49	23,3	56	23,4	25	44,6	13	23,2
5-10	32	15,2	37	15,5	16	43,2	13	35,1
10-20	38	18,1	49	20,5	28	57,1	11	22,4
20-50	28	13,3	29	12,1	14	48,3	9	31,0
50-100	16	7,6	17	7,1	7	41,2	3	17,6
100-250	15	7,1	15	6,3	8	53,3	5	33,3
250-500	15	7,1	16	6,7	10	62,5	8	50,0
500-1000	6	2,9	6	2,5	2	33,3	3	50,0
1000-	11	5,2	14	5,9	6	42,9	6	42,9
Total	210	100,0	239	100,0	116	48,5	71	29,7

There are 329 gazelles among the parent organisations, the majority of which correspond to industries 74 and 72, in which the share of gazelles is about one-quarter. The number of gazelles among verified parents is 35, almost 50 percent. The highest number of gazelles can be found in IT services, in which the turnover of one-fifth of the parents increased by more than 20 percent during three consecutive years. Over the years 1996-1999, about 90 to 100 percent of the spin-offs occurred immediately after the high growth period of the parent organisations. During the years 2000–2003, the corresponding share was no more than 55–75 percent, which indicated that spin-offs were more frequent during or before the years of high growth. Only three spin-offs from verified parents occurred a year or two before their high growth period. The main rule, however,

is that spin-offs occur after the high growth period of the parents; in addition, the number of spin-offs was the highest from 2000–2004.

6.1 Knowledge flows from parents to spin-offs

We will now consider the characteristics of the job-changers from the verified parents to their spin-offs in more detail; we will also examine the effects of these job-to-job movements on the innovativeness and performance of the spin-offs. We found that among parents, there are small and medium-sized firms, large firms and groups of firms; there are also, however, franchising groups, education and development organisations, central organisations, federations of municipalities and other public sector organisations. The question in these last cases is that of institutional spin-offs. From the largest groups of enterprises, more than ten spin-offs may have occurred annually. Sometimes, the founder of a spin-off was outside the labour force before he or she established the spin-off or began working for it full-time.

First we considered how successful the spin-offs originating from gazelles were in terms of turnover growth. There are 35 parents that are rapidly growing. In the 1996–2004 period, we found 26 spin-offs from these gazelles based on labour mobility. Six of these firms reached the high growth phase in their early years. Three of them are in sector 72 and three in sector 74. All gazelle spin-offs except for one started their operations in 2000 or 2001. The high growth period of these spin-offs occurred in the years 2002–2004 or 2003–2005. The average age of the personnel in these gazelle spin-offs in year $t = 2$ is 32 years. The average age does not differ statistically from that of other spin-offs originating from gazelle parents.

The gazelle spin-offs include the developer of the digital video recorder, which originated from the firm that designed the world's first view phone; a consulting company concentrating on research services in business management and on business assessment that originated from a large ICT agglomeration; the producer of weather monitoring and other services in road conditions management originating from public road services; an ICT company that develops Internet technology for embedded systems that originated from a Swedish electronics company; the company specialised in the renting of IT environment originating from a company that rents printers and computers, and a company that provides management consulting which originated from a media production house. Among the gazelle spin-offs, three firms provided technological innovations.

6.2 Innovative spin-offs

Among the innovative spin-offs (N = 24) originating from the verified parents, there are twelve IT firms that provide software design, supply and consultancy or digital video control or database services, four firms that do management consultancy, three technological design firms, two civil engineering or construction service firms, two firms that do product development for electronics and the metal industry and one biotech firm. In ICT technology, mobile solutions and services, process consulting, the emerging services include value-added services for digital TV, the supply of digital technology, and Internet technology and its applications. In management consultancy, there are firms that produce services e.g. for forestry; consulting companies that aid in outsourcing support services; companies that develop web-based solutions for customer satisfaction surveys, and consulting firms that aid in the implementation of the remote work. Fifteen of the spin-offs started their operation around the millennium and nine began from 1995–1999.

Although there is not a plethora of verified parents in this study, it is clear that the parents of the innovative spin-offs belong to many different industries. The majority of the verified parents belong to IT services (72) and to size class 3 (meaning firms with 10-19 employees). Parents comprise firms established earlier like IT companies, firms providing management consulting, wholesale and agency activities, companies that produce medical instruments and engineering offices. In the survey carried out by the Helsinki University of Technology, some parents declared that they belong to the public sector, such as, for example, the Ministry of Labour, the Finnish Game and Fisheries Research Institute, the National Veterinary and Food Research Institute (EELA), Turku University, and the Slot Machine Association. Six of the parents are large organisations.

Almost all job-changers that establish an innovative spin-off are graduates with technical education. There are, however, certain founders with an education in business or another field. The average age of the founders of the innovative spin-offs or of the first movers is 36 (32 for IT spin-offs). There are no persons with a post-graduate education among the job-changers. Researchers mainly move into institutional spin-offs and into spin-offs performing R&D activities that were established earlier on.

Highly educated persons from other organisations often move into spin-off in the same year that the spin-off is established. Within a few years from the start, there are also persons with an elementary or secondary education in the group of persons that join their workplace. By following the increase in the number of personnel in spin-offs over time, we find that a spin-off is typically established at a turning point in the evolution of a parent. Spin-offs may, for example, go on with the original business when the parent is reducing its personnel. The founding of a spin-off may also be related to the reorganisation of a parent or a group of firms.

6.3 Spin-offs without innovation activities

The verified parents had 59 spin-offs that did not perform any technological innovation activities. Five of these were in engineering, twenty-three in IT services and thirty-one in technical services. The number of gazelles among the non-innovative spin-offs was six, two of which are IT firms and the rest belong to management consultancy. Two spin-offs that provided management consultancy experienced high growth in the years 2001–2003 and 2002–2004. The other four had a high growth period in 2003–2005.

As an example of gazelles in the group of non-innovative spin-offs[5], there is a company that organises education in industrial safety and which originated from the Centre of Industrial Safety, which provides weather monitoring and other services in the road conditions management. There are another company that originated from public road services; a company specialised in the replacement and repair of power plant boilers; a company specialising in the rental of office technology; a company supplying marketing services for businesses that originated from a media production house, and a company specialised in web-based management information systems that originated from a firm specialised in data security solutions.

[5] Firms are defined as non-innovative if there is no indication in R&D, patenting, Tekes customership or Sfinno data that these firms have been developing technological innovations or technologies over their life time.

7. Conclusions

At the beginning of the 21st century, about 5,000-6,000 start-ups were born in Finland annually in industries 72–74, and about 2,000 in manufacturing. The majority of these newcomers were small firms employing only few persons. Annually, approximately 200–300 of these start-ups performed innovation activities. Among the start-ups, there are a greater number of high-growth firms, referred to gazelles.

The total annual number of start-ups with job-changers from other organisations was about 1,800 in manufacturing and knowledge-intensive business services. From these start-ups, about 1,200 potential entrepreneurial spin-offs can be traced annually from the administrative registers, when the knowledge flows caused by employees who changed jobs are not restricted in any way. If the spin-offs originating from business arrangements are also taken into account, the annual number of potential spin-offs can amount to 1,500 firms. Counted this way, the share of spin-offs in start-ups totals approximately 20–25 percent of all start-ups in Finland. This coincides with the expert opinions (see Tübke, p. 16). From the Employer-Employee Registers, university and research-based start-ups can also be traced, and these are already included in the figures given above (at least partially), because these registers also include public administration offices.

In this study, about 100 innovative start-ups can be found among the start-ups with job-changers annually. From these, approximately 30–60 start-ups can be verified annually as real spin-offs on the basis of surveys and interviews, meaning that respondents agree that their firm can be regarded as a spin-off. It is, however, evident that respondents often do not perceive that their firm is the spin-off of an incumbent firm, especially if the firm is operating in another industry. In the responses, public organisations are sometimes also referred to as parents. Obviously, the definition of institutional, research-based or academic spin-off is much more familiar to the respondents of business surveys than the definition of corporate spin-off.

Even though this study started by establishing that the business idea of a spin-off is not necessarily connected with the markets or technological knowledge of the parent, not all start-ups with job-changers can be regarded as actual spin-offs. This is especially the case when these are start-ups established by people who take their experience and

networks accumulated in their previous workplace with them. The possibilities of tracing the founders of a firm (except for a self-employed person) from the administrative registers are very limited. It is easier to trace the recruited employees and their competence and work experience. For that reason, it is interesting to consider the importance of the expertise accumulated in the previous workplace for the growth of all start-ups (not only of spin-offs). Start-ups seem to be divided into two groups right from the start: there are those that have gotten expertise from the previous job and those that do not have such expertise. This expertise may be related to the business idea, markets, technology, production or management. Registers as such are not capable to establish the distinction as to how this expertise is channelled and whether it stems from the managerial ability of the founder(s) or from the expertise of the (first) employees. It is quite likely that it comes from both sources.

If we, however, choose the verified corporate spin-offs (335 firms) as our point of departure and compare them with similar start-ups with job-changers, we can see that in this matched group, the binary variable that indicates real spin-offs has a significant positive effect on the occurrence of a high growth phase. The sole fact that a spin-off, on average, is larger than a greenfield firm does not explain its higher growth during its early years or the fact that spin-offs were found to reach the high growth phase more often than other start-ups with job-changers.

The difference in the growth of spin-offs compared to that of other start-ups may in principle be explained by other reasons not related to the origin of start-ups, i.e. because of unobserved heterogeneity. However, in this study we have compared the spin-offs with similar start-ups by using a propensity score matching technique. In the matched groups of firms, the technology fields, the starting sizes, the cohorts and the intentions of the firms to develop innovations and technologies are approximately the same. In addition, in explaining the likelihood of the start-up becoming a gazelle[6] we have used the following controlling factors: the binary variable describing whether the firm performs R&D activities, the share of highly educated employees, the share of employees with technical, commercial and other education, the binary variable indicating public R&D funding, the average age of the personnel and the variable describing the year cohort.

The results of the probit models show that the binary variable indicating business origin (real spin-off or not) has a significant positive impact on the likelihood of high growth in the sample of all as well as of innovative start-ups. We also found that the majority of spin-offs occur immediately after the high growth phase of the parent organisation. In years 2000–2003, spin-offs were established during the growth period or

[6] Where the annual increase in turnover exceeds 20 percent over three consecutive years (or more).

previously. The highest number of gazelle spin-offs originating from gazelle parents (N = 35) can be found in IT services and in other business services.

When studying the knowledge flows from verified parents to spin-offs, we noticed that large spin-offs mainly recruit persons with technical education, and that the majority of the employees hired by small spin-offs are graduates. Almost all employees that have moved from parent companies to innovative spin-offs are graduates with a technical education. Only a few of the transfers has a commercial education or another background. The average age of the founders or the first employees of spin-offs is 36 (32 for IT spin-offs).

During the year when a spin-off is established, employees from other organisations also come in. Within a few years, there are also persons with elementary or secondary education. When following the number of personnel over years in spin-offs, we observe that spinning-off typically occurs at the turning point in the development of the parent: the spin-off may, for example, go on with the original business when the parent starts to reduce the number of its personnel. The founding of spin-offs may also be related to the business and group level arrangements.

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Appendix A:

Table A1. Start-ups with job-changers by year and industry.

Starting year Industry SIC	1997	1998	1999	2000	2001	2002	Total
15	32	32	30	28	23	21	166
16	1	1					2
17	9	12	12	13	7	7	60
18	19	19	11	12	11	9	81
19	1	1		2	1		5
20	26	48	23	30	19	15	161
21	2	3	4	5	1	4	19
22	47	35	32	37	35	30	216
23	1						1
24	7	6	5	5	5	3	31
25	5	7	7	11	10	7	47
26	8	6	8	11	4	3	40
27	2	3		4		5	14
28	76	92	65	68	89	50	440
29	64	51	48	67	60	39	329
30		1	1	1	1	1	5
31	8	10	8	6	8	7	47
32	9	13	11	12	8	4	57
33	8	13	19	11	12	18	81
34	1	7	3	4	5	3	23
35	15	10	16	16	17	12	86
36	25	43	37	22	18	16	161
37		2	4			3	9
72	118	124	171	275	205	128	1021
73	12	6	9	8	19	8	62
74	596	677	602	708	707	546	3836
Total	1092	1222	1126	1356	1265	939	7000

Table A2. Start-ups (Ltd's) with job-changers by year and industry.

Starting year Industry SIC	1994	1995	1996	1997	1998	1999	2000	2001	2002	Total
15	21	14	17	13	17	15	11	9	10	127
16					1					1
17	4	3	1	6	5	3	2	4		28
18	4	4	5		3	2	2	4	1	25
19	1	1	1	1	1		2			7
20	37	17	16	16	21	15	17	14	8	161
21	4	6	3	1		2	1	1		18
22	40	38	30	22	18	21	23	20	11	223
23			1	1						2
24	5	3	4	2	5	1	6	1		27
25	2	11	6	2	4	5	6	5	1	42
26	10	5	7	6	4	5	3	1	1	42
27	1	3	1	2	4				4	15
28	38	47	43	50	47	33	33	44	16	351
29	36	43	32	26	22	20	25	24	19	247
30			2	1	1	1	2	1		8
31	8	7	4	8	3	7	2	5	4	48
32	2	4	7	7	9	5	7	2	2	45
33	9	5	9	6	7	10	8	6	9	69
34	5	1	2		3	2	2	1	1	17
35	1	4	4	5	4	4	8	9	3	42
36	13	9	13	12	11	12	10	8	4	92
37	1	4			1	1		1	2	10
72	69	44	66	71	52	109	182	119	66	778
73	6	5	4	6	5	6	7	12	6	57
74	358	307	283	249	255	207	298	245	154	2356
Total	675	585	561	513	503	486	657	536	322	4838

Start-ups seem to be divided into two groups right from the start: there are those that have gotten expertise from the previous job and those that do not have such expertise. This expertise may be related to the business idea, markets, technology, production or management. In this report clear evidence has been found that this expertise really matters for the growth of start-ups, no matter whether it stems from the managerial ability of the founder(s) or from the expertise of the (first) employees. It is quite likely that it comes from these both sources.

This report contributes to the discussion on how many innovative corporate spin-offs there are annually in Finland (we got about 60–100) and on how they can be identified and their significance analyzed. It is obvious that focused surveys and case studies are needed if, for example, the relationships between parents and spin-offs are under examination. On the other hand, it comes up that employer–employee data are useful for the first-hand indentification of spin-offs, as well as for the broad-based analysis of their economic impact.

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