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- Patterns of Entry and Exit

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Abstract

The motivation of this paper is to add new, large sample evidence on the extent to which the likelihood of business failure or success is related to relationships between parent firms and their 'off-spring'. For this purpose we make use of an exhaustive matched employer-employee data set covering the entire Danish private sector in years 1981 to 2000 to study firm entry and exit. Special focus is on spin-offs, a particular group of small entries, which are founded by groups of persons originating from the same former workplace.

We estimate a multinomial logit model in order to examine which characteristics of the founders and the parent firms increase the probability of spinning off. Next, we carry out a duration analysis of the subsequent transitions of the spin-offs, and compare their exit risks with those of other entries, which have less strong parent-progeny relationships in terms of worker flows.

With respect to entry, poor performance of the parent firm is found to be a key determinant of the decision to spin off. The spin-offs are shown to have a lower death risk than the comparison group, also after controlling for a host of firm and employee characteristics. The exit risks of spin-offs and the comparison group are observed to converge over time. However, when we cater for unobserved heterogeneity the convergence turns out to be predominantly an outcome of selection rather than the result of other start-ups catching up via some learning process.

For the entire sample of entries, we find a positive association between size of the entry and survival probability, and a countercyclical sensitivity of exit risk.

Keywords: Entry, Exit, Spin-offs, Duration analysis

JEL classification: L11, L25, M13

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1 Introduction

It is a commonplace to think of new firms as one of the key drivers of economic growth and increasing prosperity as they outperform older firms thanks to the absence of organisational inertia present in the latter. A substantial literature has built up documenting a series of stylised facts (discussed by Geroski (1995) and Caves (1998)), one of which is that across industries and several countries (see e.g., Geroski (1991), Baldwin (1995), Bartelsman and Doms (2000), Bartelsman, Scarpetta and Schivardi (2003)) entry of new firms is common, but at the same time entrants suffer from high rates of infant mortality and hence, "net entry" is considerably lower. The great majority of these studies do not, however, distinguish between different types of new firm start-ups; in particular not with respect to the origins of the entrant firms' employees. And yet, Jovanovic's (1982) passive learning model and Pakes and Ericson's (1998) active learning model both imply that when the entrants differ with respect to the knowledge they possess about the cost levels and other factors in their industry when making their entry investments, they are going to fare differently during the years of their existence.

One form of entry that has attracted a lot of attention in recent years is 'spin-offs', a term which describes entries whose impetus originates from within an existing company. These entries take advantage of assets like industry-specific knowledge (Jovanovic (1982), Pakes and Ericson (1998), Helfat and Lieberman (2002)) or personal networks which are transferred by its founders from the former employer to the entry. In addition, these entries gain from the fact that the founders know each other from their time as colleagues and therefore start off with high levels of mutual trust and well developed communication practices (Phillips, 2002).

Because these firms can draw on these intangible assets, spin-offs are frequently assumed to perform better relative to other firm start-ups, *i.e.*, they grow faster, have higher survival rates, *etc.* A number of studies on spin-offs − Dietrich and Gibson (1990), Sleeper (1998), Lindholm (1994), Walsh et al. (1996) − have indeed found entrepreneurial spin-offs to be characterised by high growth and high survival rates. These studies have, however, been based on rather small and unrepresentative samples (or even case studies). Moreover, earlier research has only to a limited

extent compared the development of spin-offs with other start-ups or made use of longitudinal information.[1]

The aim of this paper is to examine spin-offs with between two and ten employees and the entry and survival of these spin-offs using an exhaustive matched employer-employer dataset on all Danish firms during the period 1981-2000. The basic strategy is to categorise firm entries by the worker flows associated with entry, and to compare the firm death risks across the categories. We have a large sample of about 27,000 entries, of which 5,000 are characterised as spin-offs, and can follow these entries for up to 19 years. Our spin-off definition does neither require the spin-off to be in the same industry as the incubator firm (although we will address whether or not this is an important determinant of survival), nor does it require the spin-off to be located in some 'high-tech' industry.

The two main hypotheses studied are: (1) Spin-offs have a higher probability of survival, and (2) industry-specific intangible assets are an important determinant of firm success. An additional research question that we try to answer is: given that spin-offs are initially more successful, how long does it take for other firm entries to catch up? It should be noted that the focus in this paper is exclusively on entries spinning off from (private sector) firms, *i.e.* corporate spin-offs, which distinguishes this analysis from the literature on spin-offs generated by research institutions (Callan 2001).

Before plunging into the empirical analysis, we generate some descriptive statistics on spin-offs, and relate the spin-off dynamics to business cycle movements as we want to provide some heuristic evidence on whether or not the decisions to create a spin-offs are mostly of push- (owing to unfavourable conditions at the parent workplace/firm) or of pull-nature (due to some perceived business opportunity). Another way of investigating this question is to take the perspective of the individual and her firm and search for general patterns correlated with the decision to spin off. We follow this strategy, too, and estimate a multinomial logit model in which we relate the probability to spin off to parent firm and individual characteristics.

As for the business cycle influences, we find that spin-off activity is lowest in times of economic recovery, whereas both periods of recession and stable growth are associated with increases in the

[1] A notable exception is Phillips' (2002) analysis of Silicon Valley law firms.

spin-off frequency. The multinomial logit estimates indicate that growth in sales per employee is negatively related to the propensity to spin off. This indicates that spin-offs are typically 'pushed' rather than 'pulled'. Founders of spin-offs are found to be older and have longer job tenure at the parent firm than other start-up entrepreneurs. They are also more likely to start a spin-off if there has been a shift of the CEO of the parent firm within the last two years.

We find spin-offs to be associated with lower death risks than other entries, even after controlling for a number of observed characteristics, and observe convergence in exit risks between the group of spin-offs and the group of other entries. We estimate a duration model that suggests that this observation is mainly a result of selection rather than actual convergence in risks at the level of the individual firm. Industry-specific capital is suggested to be an important determinant of survival in the short-run, but not after the first 3-4 years of the existence of the firm. This indicates that non-spin-offs catch up with respect to this factor.

The remainder of the paper is organised as follows. Section 2 gives a brief review of the earlier research on the topic. Section 3 presents our strategy for identifying spin-offs from linked employer-employee data. Section 4 contains the results concerning entry activity, the relationship between spin-off birth and the business cycle, the individual and (parent) firm characteristics of the employees of spin-off births. The estimations of our duration model are presented in Section 5 and Section 6 concludes.

2 Earlier Research

The theoretical literature on spin-offs identifies a number of motivations for spin-offs. These include that spin-offs emerge in connection with technological innovations (Wiggins 1995), or that spin-offs are a consequence of frustration due to organizational inertia in the parent firm (Cooper 1985). An important distinction is whether the decision to start a spin-off is made by the top-management of the parent firm or by individual employees. This distinguishes 'parent spin-offs' from 'entrepreneurial' spin-offs (Helfat and Lieberman (2002), Klepper (2001)).

The empirical literature on spin-offs often analyses spin-offs generated by a single incubator (e.g. Lindholm 1994, Chesbrough 2002) or specific projects or industry clusters (e.g. Roberts and Wainer 1968, Møen 2002, Dahl et al. 2003, Sleeper 1998).[2] The performance of spin-offs with respect to growth and survival is typically found to be above average. This result is, however, conditional on the parent being 'healthy'. This finding and indications of the positive effect of a strong parent-progeny relationship is consistent with evolutionary organizational theory's focus on the inheritance of routines and procedures from the parent firm to the spin-off (Helfat and Lieberman 2002). The routines transferred from the parent to the progeny may be an asset, as for example procedures that do not have to be developed. But they may also hinder optimal adaption of the organization. This is emphasized by sociological studies of organizational change which analyse the impact of characteristics present at the time of the founding of firms (Hannan and Freeman (1984), Sørensen and Stuart (2000)), and economic analysis of the entrenchment of firms' executives (Holmström (1989)). In a study on 513 Silicon Valley law firms, Phillips (2002) finds the strength of the parent-progeny relationship - as measured by the rank of the founder the spin-off in the parent firm - to be positively related to subsequent survival probabilities of the entries.

Our analysis differs considerably from most of the earlier literature, but comes closest to Philips (2002). We extend his methodology by entering time-varying coefficients to allow for decreasing importance of the characteristics at the time the firm is started. Thus we can examine how long it takes for the differences in exit risks between different firm entry categories to fade out. Another novel feature is that we account for unobserved heterogeneity in our estimations.

3 Identification of spin-offs with matched employer-employee data

This section presents our strategy for identifying spin-offs and other forms of firm entries from register data, or more precisely, linked employer-employee data. While this type of data has the advantage, relative to survey data, of providing us with large samples and objective measures of variables, they contain no direct information on the decision making processes and motivations that

[2] There is a much larger empirical literature examining the performance differences between new and established firms relating them to industry conditions like number of firms in the industry, market size, etc.; see e.g. Geroski (1995) and Caves (1998) for discussions of this line of research.

underlie firm creation and which could be used to categorise firm entries. They do, however, have valuable information on the origin and composition of worker flows associated with firm creation, which we use in categorizing firm entries (following the same strategy as Nås et al. (2003)).

The data we use emanate from a sub-sample of the 'Integrated Database for Labour Market Research' (or 'IDA') constructed by Statistics Denmark, and administered by the Center for Corporate Performance at the Aarhus School of Business. The sub-sample encompasses all individuals who have been employed in the private sector at any time during the period 1980-2000. These employee records are for each year linked to their employer by both a firm and a workplace identification code, where firms are defined as legal units liable to the tax authorities[3]. By tracing changes in firm and workplace identification numbers in adjacent years, we find about 200,000 firm start-ups during the period 1981-2000. These start-ups are next categorised based on information about their employees and in particular about where these were employed or were doing the year before the start-up.

We group the employees of the newly started firm according to their prior workplaces or, if an individual was not employed, by the employee's labour market status (education, unemployment, etc.). The prior workplace or labour market status of the largest group, henceforth called 'movers', defines the parent workplace. The origin of the movers and the size of the group of movers in relation to the size of staff of the parent firm (if existing) and the total staff of the entry in its first year of existence will define the categories. Later, we apply the same methodology for the identification of the destination states of the entries' subsequent transitions. Clearly, it is not possible to make any distinctions into start-up categories based on worker flows for one-person entries. For this reason, we restrict the sample of entries to consist of new firms with at least two employees in the first year of the firm's existence.[4]

[3] A problem with this kind of data is that integrated organizations may have been split up into different legal units. Occasional observation suggest that there are indeed large firms who consist of more than one legal unit. However, there is only a limited number of large firms in the sample, which is a consequence of Denmark's industry structure being characterised by mostly small and medium size firms. In addition, the limited number of subdivisions in large firms implies that most of the legal units will be too large in order to constitute a problem for the present analysis, which concentrates on entries with less than or equal to ten employees.

[4] When working with the data, we observed a number of start-ups in the data with large numbers of employees (up to several hundreds of employees). To reduce the impact of these large-scale entries - which are not in focus of this assessment - on the subsequent analysis, and to make the sample more homogenous with respect to size at time of entry, we also impose an upper bound on firm size and only sample firms with less than or equal to ten employees.

We only consider entries formed by persons with a close labour market attachment, and discard those entries from the sample, for which the largest group of employees has not been employed in the year before entry. For the resulting sample of small firms, we define four different entry categories, which are presented in *Table 1*.

Table 1: Categorizations of firm-start-ups

Number of movers[1] as proportion of of total number of employees in start-up	Number of movers as proportion of total number of employees in parent workplace	Parent workplace survives	Category name
Less than or equal to 50 %			FDS[2], base category
More than 50 %	Less than or equal to 50 %	No	Pushed spin-off
		Yes	Spin-off
	More than 50 %		Shifts id

1: 'Movers' are those persons in the entry with the same parent firm affiliation

2: FDS='from different sources'

The categorisations are implemented as follows. We distinguish between whether or not the persons from the same former workplace make up more or less than 50 percent of total staff of the entry (in the first year of existence). If the fraction is less than 50 percent (entries for which only a minor fraction of employees has been with the same employer in the year before), the start-up belongs to the category "from different sources (FDS)", or simply "the base category".

Spin-offs are those firms, which have a strong connection to a former workplace, but bare not business units that simply continue their operations. The first condition is captured by the requirement that at least 50 percent of the employees in the spin-off come from the same parent workplace, the second is implemented by the condition that the movers are only a minor group - less that 50 percent of staff - of the *former* workplace. Note, that these somewhat arbitrary thresholds are used under the implicit assumption that the relationships studied in the later parts of the paper are monotonic within the range over which the thresholds may be set.

The number of persons moving from the parent to the spin-off is used as a proxy for the strength of the parent-entry relationship. The category FDS differs from spin-offs in that this relationship is stronger for spin-offs. Note, that unlike in *e.g.* Klepper (2001), our definition of spin-offs does not include any condition that they have to be in the same industry as the parent workplace. We will, however, use this extra information in the subsequent analysis.

It should be stressed that categorisations based on worker flows alone do not necessarily correspond to the transfer of knowledge being the key factor in other spin-off definitions: one person may be enough to transfer a business idea or industry-specific human capital from her employer into a newly started company, which makes any entry with one employee who has previously been employed somewhere a potential spin-off. Clearly, there may also be considerable transfers of intangibles from some parent firm to the progeny for those entries categorised as FDS. The volumes of these transfers are, however, generally larger in the group categorised as spin-offs compared to the baseline category.

We wish to distinguish between whether or not there is a strong push factor motivating the start of a spin-off and have therefore created a distinct category for those spin-offs for which the parent workplace stops operations in the same year as the spin-off is launched. These entries, for which spinning off is a survival strategy will henceforth be called 'pushed spin-offs'.

The group of new firms in the data classified as 'shift id-code' comprises entire workplaces which are divested or firms which were mistakenly given a new identifier in the data, and which therefore appear as new firms in the data. Entries in this category are not in focus of this assessment, and will be dropped from the sample in the following. Instead, focus will be on spin-offs, pushed spin-offs, and FDS, as these form reasonable homogenous groups for comparisons. These categories comprise approximately 34,000 entries in the period 1981 to 2000.

In order to track the subsequent histories of the entries, we define, similarly to the entry categorisations, four transition categories. These are summarised in Table 2.

Table 2: Categorizations for destinations

Firm survives until year 2000	Movers[1] are employed in year after drop-out	Movers return to original parent firm	Number of movers as fraction of total number of employees in drop-out	Category name
Yes				Right censored
No	No			Death
	Yes	No	Less than or equal to 50 %	Split up
			More than 50 %	Other destination
		Yes		

1: 'Movers' denotes individuals finding themselves in the largest group of employees going to the same destination.

Only the transitions 'Death' and 'Split up' in Table 2 are identifiable as firm exits. These exits are business failures in the sense that, at the time of exit, continued operation of these firms as integrated business units has not been considered worthwhile. The transition 'Other destination' typically captures ownership changes.

4 Patterns of Entry

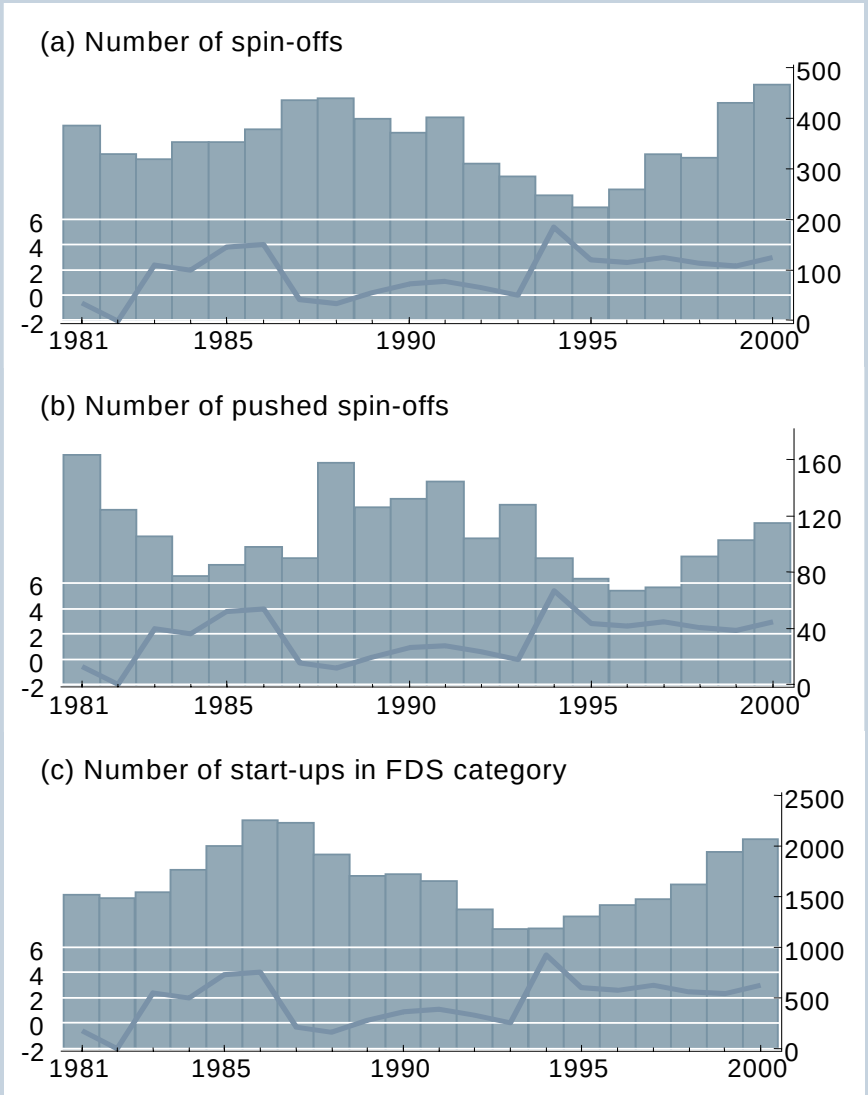
Based on the categorisations defined above, we now turn to look at: (i) how firm creation patterns vary over the business cycle, and (ii) how spin-off creation is related to (parent) firm and individual characteristics.

4.1 Firm entries and the business cycle

We begin with firm entry behaviour over the business cycle. The business cycle during the observation period can be shortly summarised as follows: relatively strong growth in real GDP in periods 1983-1987 and after 1993, and sluggish or negative growth in periods 1981-1982 and 1987-1993. From *Figure 1* we can see that the spin-off activity is lowest in times of economic recovery, while both recession and stable growth periods are associated with higher spin-off frequencies. The same pattern is observed also for the FDS category. For spin-offs, the parent company of which dies, the movements are countercyclical up to the end-nineties, where their numbers increase despite continuous high economic growth.

Figure 1: Firm entries in Denmark 1981-2000

Numbers of entries with between two and ten employees on RHS scales
GDP growth in percent on LHS scales



The decision to start up a business may either be 'pulled' by the market or by the wish to exploit the gains from a business idea on one's own without sharing the rents with the parent company. The

reason for why the parent company is unable to implement the business idea may be that the founders of the spin-off are more entrepreneurial (less risk-averse) than the parent company. Another possibility is that employees become frustrated with their careers at their former employer. Spin-offs are not necessarily related to some perceived business opportunity, but may simply be a result of career considerations, rent sharing problems, or the wish to have more control of one's working life.

The peaks observed in the number of spin-offs in times of low GDP growth support the "push" explanation, while the increase in the late nineties in a period of stable growth is more consistent with the "pull" story. A potential explanation for why there is no immediate drop in neither spin-off activity nor the number of FDS start-ups in economic downturns may be that the persons starting up the company are slow in adjusting their perceptions with respect to market conditions to the lower level of economic activity.

As expected, we find a countercyclical time pattern for pushed spin-offs. Obviously, the push mechanism is of major importance for the motivation of these start-up categories. There is, however, no straightforward explanation along these lines for the increase in the numbers for these categories in the late nineties.

4.2 Who spins off?

Which firms are most likely to function as incubators, and which persons are most likely to leave a company with entrepreneurial motives? The data at hand allows us to relate both firm level and personal level information to the probability of spinning off, and to examine some of the hypotheses discussed above. The advantage of having both firm and personal level information is that each set of variables acts as a set of controls for the other, thereby taking account of the selection occurring when persons with specific characteristics choose to work in specific firms.

The firm level variables included are: growth of sales per employee as a measure of firm performance, shifts of the CEO as a proxy for internal turmoil, number of employees, and industry dummies. Individual level variables included are: the employee's (ISCO) job category, age, gender, tenure in the firm, and as a measure of the generality of skills (*cf.* Lazear (2002)) the number of

different job positions held since 1980. We allow for seven transition possibilities for each employee: (i) stay with the firm, (ii) move to another already existing firm (denoted as *Go to 'old' firm*), (iii) become unemployed or drop out from the labour market (denoted as *Unemployment, drop out*), (iv) start a spin-off with less than or equal to ten employees (*Start spin-off*) − *i.e.* be one of the 'movers' defined in the forgoing section, (v) move to an entry which fulfils the conditions of our spin-off definition, except that initial size is larger than ten employees (*Be divested*), (vi) start a one-man firm (*Become entrepreneur*), and (vii) start in any new firm (*Go to other new company*) without being defined as a 'mover'.

The size of the sample for this exercise was restricted by the availability of firm (financial) background information. We are following transitions of employees between November 1997 and November 1998, as 1997 is the last year for which we have all relevant background information. The sample consists of about 2000 (mostly manufacturing) firms and about 600,000 employees. Of these employees, 74 per cent stayed with their current employer, 15.5 per cent moved to another already existing firm, 7 per cent moved to unemployment or dropped out of the labour market, 0.13 percent started a spin-off, 2.5 were 'divested', 0.4 started one-man firms, and 0.4 percent were classified as 'Go to other new company'.

Table 3 gives mean values for the persons and firms in our sample for year 1997. Compared to most other transitions, individuals starting spin-offs are on average more likely to be males, are older, more highly educated, have stayed longer with their previous employer but have held a greater number of jobs, and are more likely to be at the upper end of the skills distribution. They are younger and have less firm tenure than those staying in the same firm. The firms at which the spin-off employees were employed before, are on average characterised by a clearly below average growth rate, a considerably smaller number of employees, and by a higher likelihood that the chief executive has been turned over in recent years. Incubators are over-represented in the construction and financial sectors but relatively uncommon in manufacturing.

Table 3: Mean values of personal and incubator characteristics by transitions 1997

General personal characteristics

Transition	Male	Age	Highly educated[1]	Tenure at firm	Number of prior jobs[2]
Stay with firm	0.69	38.21	0.05	5.93	2.81
Go to 'old' firm	0.69	30.52	0.04	2.67	2.87
Unempl.; drop out	0.57	34.50	0.02	3.46	2.50
Start spin-off	0.73	35.08	0.07	4.17	3.03
Be divested	0.74	36.44	0.07	5.11	2.88
Become entrepreneur	0.68	30.33	0.03	2.37	2.78
Go to other new company	0.66	30.31	0.04	2.44	3.00
Total	0.68	36.68	0.04	5.22	2.80

Personal characteristics: job classifications [ISCO classifications]

Transition	Executives [1]	Specialists [2]	Skilled [3]	Office [4]	Sale/service [5]	Agriculture [6]	Craft [7]	Processing [8]	Other [9]
Stay with firm	0.05	0.08	0.15	0.09	0.07	0.01	0.20	0.2	0.15
Go to 'old' firm	0.03	0.06	0.11	0.09	0.12	0.01	0.19	0.1	0.24
Unempl.; drop out	0.03	0.03	0.07	0.07	0.12	0.01	0.14	0.2	0.30
Start spin-off	0.07	0.13	0.18	0.11	0.07	0.01	0.20	0.1	0.17
Be divested	0.04	0.11	0.18	0.09	0.07	0.00	0.17	0.2	0.17
Become entrepreneur	0.05	0.05	0.09	0.08	0.13	0.01	0.17	0.1	0.30
Go to other new company	0.04	0.07	0.13	0.08	0.15	0.01	0.17	0.1	0.24
Total	0.05	0.07	0.14	0.09	0.08	0.01	0.20	0.2	0.17

Incubator characteristics : industry / *Other incubator characteristics*

Transition	Manufactu-ring	Con-struction	Trade, hotels, etc.	Transport, communi-cation	Finance	Services	Growth in sales (in percent)	Number of employees	New CEO[3]
Stay with firm	0.53	0.08	0.27	0.04	0.07	0.01	7.06	1283.0	0.52
Go to 'old' firm	0.43	0.09	0.34	0.05	0.08	0.01	5.03	1011.8	0.52
Unempl.; drop out	0.51	0.07	0.32	0.03	0.05	0.01	6.00	1461.9	0.54
Start spin-off	0.30	0.13	0.32	0.06	0.19	0.00	1.50	322.2	0.61
Be divested	0.37	0.06	0.31	0.15	0.11	0.01	7.15	1733.0	0.47
Become entrepreneur	0.38	0.11	0.38	0.05	0.07	0.02	5.47	1058.1	0.53
Go to other new company	0.36	0.10	0.39	0.05	0.09	0.01	4.65	974.3	0.54
Total	0.51	0.08	0.28	0.04	0.07	0.01	6.66	1260.5	0.52

Notes:

1: 'Highly educated' is dummy variable taking the value one if the length of education is equal to or longer than 16 years, and zero otherwise.

2: This variable is the number of changes in 1-digit occupation codes (provided by Statistics Denmark) since 1980; it provides information on the number of prior jobs which the person has hold.

3: The CEO is defined as the top salaried professional with ISCO 1210; 'NewCEO' is a dummy variable taking the value one if the CEO is in charge for less than or equal to two years.

In order to investigate the extent to which individual and firm characteristics predict who will start up spin-offs and other firm entries we have estimated a multinomial logit model. The results of the estimations are displayed in *Table 4*. They largely replicate the findings of the descriptive statistics: Male employees in the higher rungs of hierarchy are more likely to start in a spin-off than to remain

with the same firm. Highly educated employees do not. The probability to start up or join in a spin-off compared to staying is falling in elapsed tenure with the firm.

The number of prior jobs held by the employee does not increase the probability of being in a spin-off relative to remaining in the same firm. However, for becoming an entrepreneur the number of previous jobs makes a difference. This makes sense insofar that the single entrepreneur needs general skills, whereas this is less important when the new firm has several employees. The same argument may be employed to explain the observation that being a specialist, a skilled or an office worker is positively related to the likelihood of spinning off, but does not increase the probability to start a one-man firm, while being employed at the executive level is suggested to increases the probability of both transitions.

The likelihood of spinning off decreases with the sales growth and size of the potential incubator firm. The two latter effects are substantially stronger than for other transitions.[5] A recently appointed CEO in the firm increases relatively strongly the probability that an employee in that firm joins or starts a spin-off.

[5] See Cooper (1971) for a discussion of potential explanations of why smaller firms have higher spin-off rates, and Wagner (2003) and Blanchflower and Meyer (1994) for empirical studies on the relationship between incubator size and the number of employees leaving the firm to become entrepreneurs.

Table 4: Estimation of multinomial logit model for transition probabilities

Base category: transition 'Stay with present firm' [1]

Transitions:	Start spin-off		Go to 'old' firm		Unempl.;drop		Get divested		Become entrepreneur		Go other new firm	
	Coeff.	Std.	Coeff.	Std.	Coeff.	Std.	Coeff.	Std.	Coeff.	Std.	Coeff.	Std.
Personal characteristics												
Male	0.191	0.090	0.122	0.009	-0.443	0.012	0.267	0.021	0.108	0.048	0.022	0.050
Age	0.013	0.022	-0.085	0.002	-0.215	0.003	-0.119	0.004	-0.126	0.011	-0.055	0.014
Age^2	0.000	0.000	0.001	0.000	0.003	0.000	0.001	0.000	0.001	0.000	0.000	0.000
Highly educated	0.002	0.156	-0.069	0.022	-0.361	0.044	0.197	0.039	-0.271	0.137	-0.042	0.118
Tenure	-0.074	0.024	-0.178	0.003	-0.232	0.004	-0.032	0.006	-0.188	0.016	-0.157	0.017
Tenure^2	0.002	0.002	0.006	0.000	0.010	0.000	0.001	0.000	0.006	0.001	0.004	0.001
Number of prior jobs	0.022	0.024	0.036	0.003	-0.022	0.004	0.012	0.006	0.036	0.015	0.069	0.015
Executive	1.088	0.197	0.124	0.023	-0.371	0.034	0.017	0.047	0.483	0.115	0.548	0.131
Specialist	1.019	0.187	0.033	0.020	-0.810	0.036	0.300	0.039	-0.127	0.122	0.405	0.118
Skilled	0.893	0.164	0.056	0.015	-0.702	0.024	0.293	0.030	-0.061	0.091	0.399	0.093
Office worker	0.721	0.183	0.031	0.017	-0.503	0.025	0.101	0.037	-0.048	0.099	0.199	0.106
Job in sale; service	0.615	0.206	0.380	0.017	-0.011	0.023	-0.160	0.041	0.443	0.090	0.761	0.098
Job in agriculture	0.795	0.469	0.193	0.052	0.323	0.061	-0.153	0.129	0.439	0.252	0.492	0.299
Job in crafting	0.606	0.162	0.056	0.014	-0.395	0.020	0.086	0.030	-0.008	0.080	0.289	0.088
Other job specification	0.613	0.166	0.241	0.014	0.118	0.018	0.026	0.032	0.438	0.075	0.515	0.086
Incubator characteristics												
Construction	0.747	0.124	0.188	0.014	-0.048	0.023	0.044	0.038	0.447	0.074	0.463	0.079
Trade, hotels, etc.	0.405	0.100	0.028	0.010	-0.175	0.015	0.545	0.023	0.190	0.054	0.254	0.057
Transport, communication	0.839	0.161	0.320	0.018	-0.079	0.031	1.671	0.028	0.296	0.102	0.465	0.103
Finance, business activities	1.024	0.119	0.153	0.016	-0.012	0.027	0.800	0.032	0.298	0.088	0.260	0.089
Services	-0.703	0.712	-0.165	0.047	0.075	0.055	0.635	0.099	0.713	0.169	0.220	0.230
Growth in sales	-1.179	0.205	-0.423	0.024	-0.451	0.037	-0.430	0.054	-0.199	0.129	-0.454	0.134
Number of employees / 1000	-1.111	0.096	-0.219	0.007	0.048	0.009	0.392	0.012	-0.259	0.040	-0.292	0.043
(Number of employees/1000)^2	0.092	0.010	0.018	0.001	-0.005	0.001	-0.037	0.001	0.022	0.004	0.024	0.005
New CEO	0.447	0.074	0.008	0.008	0.055	0.011	-0.264	0.017	0.039	0.041	0.092	0.044
Constant	-5.843	0.472	1.204	0.047	2.748	0.062	-1.399	0.103	-2.184	0.240	-3.415	0.271

1: Multinomial logit estimates based on the labour market transitions of 592,187 employed individuals in 1997. Exponentiated coefficients correspond to the expected changes in the probability ratios P(j)/P(Stay with current firm) related to one-unit changes in the respective explanatory variables, where P(.) denotes probability and j=(Start spin-off, Go to 'old' firm, etc.).

5 Patterns of Exit

In this section we study the success of the newly started firms in terms of survival. One of the key questions addressed is whether spin-offs have a lower death risk than the FDS category. We begin with some basic descriptive statistics, and continue with explicitly modelling the duration up to exit, conditioning on a number of observable firm characteristics. The econometric techniques applied are those of duration analysis; see e.g. Lawless (1982), Kiefer (1988), and Lancaster (1990). The analysis is based on approximately 27,000 entries in all industries except trade, hotels and restaurants.[6]

5.1 Unconditional exit probabilities

Table 5 presents the subsequent transitions for the different entry categories. In order to avoid left and right hand censoring problems, this table only uses five-year intervals, and only considers entries, which started before 1995. We may note that about 45 percent of the entries survive the first five years. The group of start-ups categorised as 'FDS' has higher exit rates − defined by either 'Death' or 'Split up' − than the spin-offs and pushed spin-offs. As is clear from the table, there are considerable differences in the exit risks across entries categorised by worker flows. The remainder of this paper will address this issue in more detail, in particular with respect to the time dimension.

Table 5: Exit destinations within first five years of existence (firm numbers and percentages)

Start-up category:	Drop-out category:	RightCens[1]	Death	Split up	Other destination	Total
From different sources (FDS)	Numbers	6829	1126	3939	3287	15181
	Percent of Total	45.0	7.4	25.9	21.7	100.0
Pushed spin-offs	Numbers	520	86	277	310	1193
	Percent of Total	43.6	7.2	23.2	26.0	100.0
Spin-offs	Numbers	1883	182	679	910	3654
	Percent of Total	51.5	5.0	18.6	24.9	100.0
Total	Numbers	9232	1394	4895	4507	20028
	Percent of Total	46.1	7.0	24.4	22.5	100.0

The definitions of the entry and exit categories are summarised in Table 1 and Table 2.
The table contains information on all entries in the period 1981-1995.
Notes: 1: RightCens comprises entries that survived for 5 years or longer

[6] The reason for excluding these firms is their very large number compared to other industries; see Nås et al. (2003). By including them we would have the problem that the results are dominated by a single sector.

Turning to the timing of exit, we find a high infant mortality and (before controlling for any sort of heterogeneity) a negative age-risk relationship. This is illustrated in *Figures 2a-2b*, which display the Kaplan-Meier estimates of the (unconditional) hazard functions. Exit rates are about twelve per cent in the first year and about four per cent in the long run which is in line with previous, comparable studies; see *e.g.*, Baldwin (1995). Figure 2a does not show any differences in the unconditional probability of exit between pushed spin-offs and the base category. On the other hand, Figure 2b suggests that spin-offs have a lower exit risk than the base category during the first years of their existence. Thereafter, hazard rates are almost constant at levels hovering between 2 and 5 percent.

Figure 2a:
Kaplan-Meier hazard rate estimates:
Entry categories *FDS* vs. *Pushed Spin-offs*

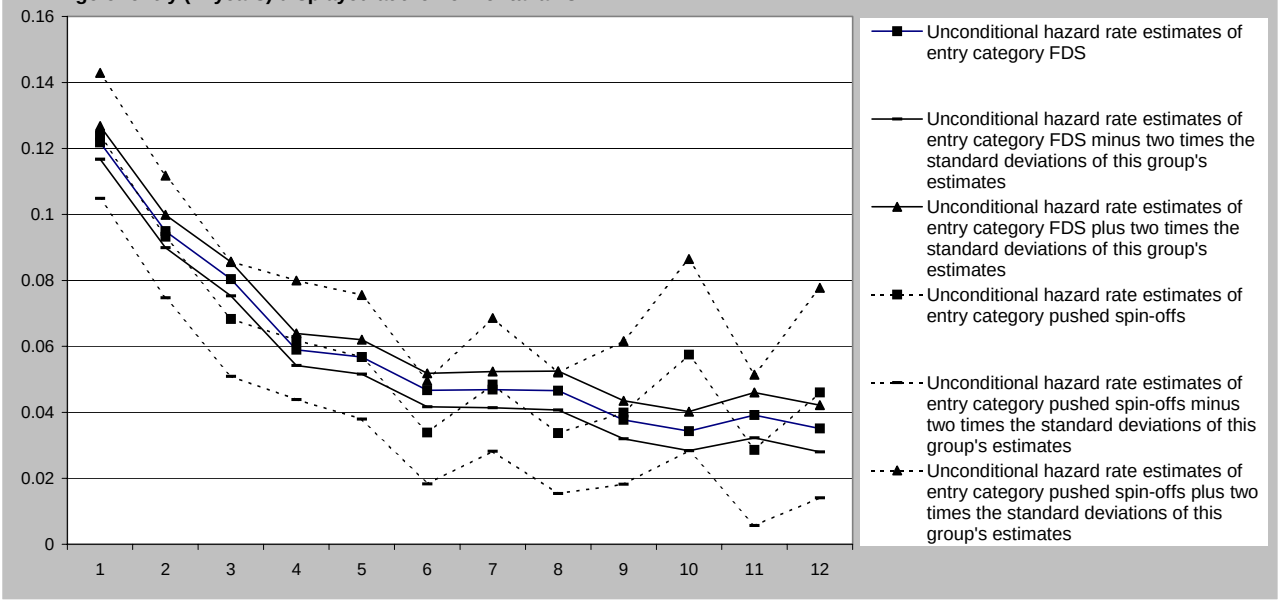
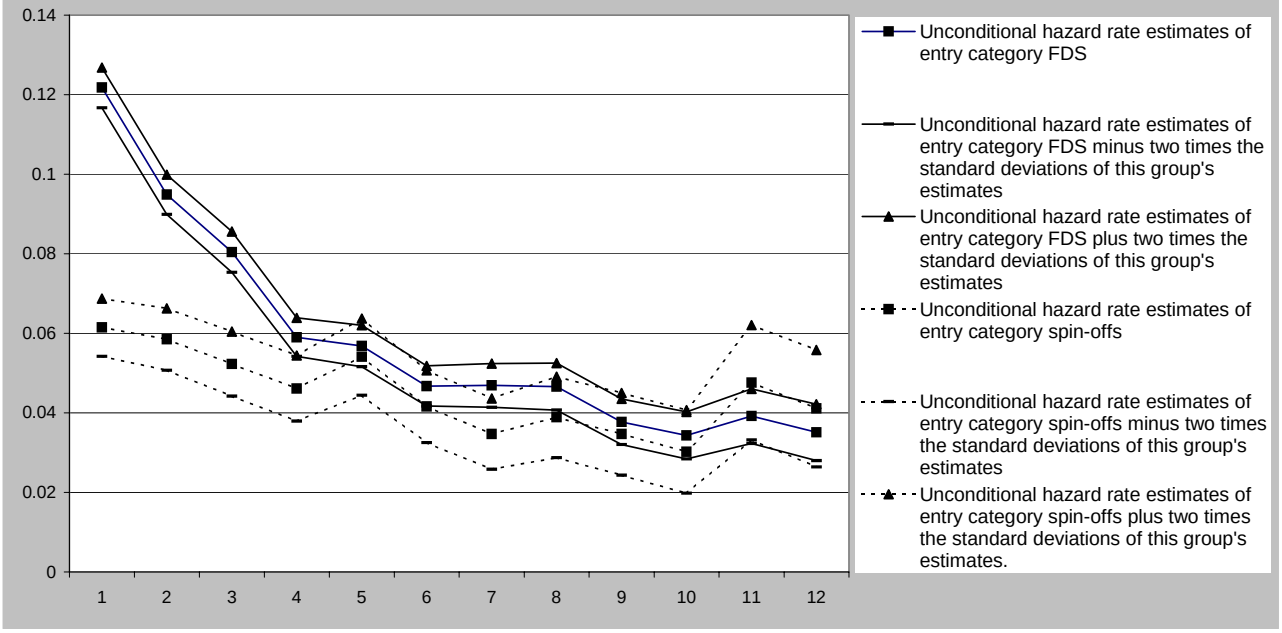


Figure 2b:
Kaplan-Meier hazard rate estimates:
Entry categories *FDS* vs. S*pin-offs*
Age of entry (in years) displayed at the horizontal axis



The observed convergence in exit rates of the FDS entries and spin-offs, respectively, is consistent with two alternative interpretations. The first is that the FDS entries, by learning about the market or by creating networks, are catching up with the spin-offs. A second possibility is that there is large heterogeneity in the group of FDS entries implying that convergence is a result of the least fit FDS-entries exiting early. Thus, after some years, so to say, only the fittest remain in the sample. Naturally, the entries may differ according to a wide range of characteristics not captured by the entry categorisations, and these differences could explain the hazard rate differences observed as well as the changes in them over time. If we want to know whether spin-offs as such perform better, we therefore need to control for all other potentially important factors which are correlated with either entry categorisation. Obviously, we cannot claim to be able to do this completely, but we can at least control for part of the heterogeneity by adding a number of explanatory variables to the model, in order to see whether the above-mentioned observations remain unchanged.

5.3 The duration model

The choice of additional controls is largely determined by the variables available in the dataset. We include the number of employees, industry dummies, and a few characteristics of the individuals

behind the entry. The latter are the mean age of the staff, the fraction of male employees, and the proportion of persons with a university degree education in the entry firm during the year it started. For the entry categories 'spin-offs' and 'pushed spin-offs', dummies for whether or not these entries operate in the same industry (at a 2-digit level) as the parent workplace are included, too. This allows us to examine the role of industry-specific assets which are transferred to the entry.

In addition to the variables described above, we included growth in GDP as a time-varying additional explanatory variable. Under the assumption that the association between this variable and exit risk is symmetric across all firms in the sample, this variable enables us to identify the effects of timing (as captured by this variable) from cohort effects, as captured by the time dummies. Descriptive statistics for each entry category are given in *Table 6*.

Table 6 : Descriptive statistics

Variable	Spin-offs Mean	Spin-offs Std.	Pushed spin-offs Mean	Pushed spin-offs Std.	FDS/ Base category Mean	FDS/ Base category Std.
Number of employees (in first year)	3.98	2.14	4.00	2.07	3.40	1.95
81-85[1]	0.25	0.43	0.25	0.43	0.24	0.43
86-90	0.29	0.45	0.29	0.45	0.30	0.46
91-95	0.21	0.41	0.25	0.43	0.20	0.40
96-2000	0.26	0.44	0.21	0.41	0.26	0.44
Industry dummies						
Construction	0.19	0.39	0.26	0.44	0.19	0.39
Agriculture	0.03	0.17	0.04	0.19	0.09	0.29
Manufacturing	0.20	0.40	0.26	0.44	0.15	0.35
Electronics	0.00	0.04	0.00	0.00	0.00	0.03
Transport	0.07	0.26	0.06	0.24	0.09	0.29
Finance	0.30	0.46	0.23	0.42	0.25	0.43
Services	0.14	0.35	0.07	0.25	0.16	0.36
Copenhagen area[2]	0.29	0.45	0.27	0.44	0.26	0.44
Share of males	0.68	0.34	0.73	0.31	0.67	0.35
Mean age	35.99	7.81	35.13	7.54	32.38	7.95
Share of highly educated[3]	0.07	0.18	0.04	0.13	0.05	0.15
Same industry[4]	0.60	0.49	0.60	0.49	0.00	0.00
Number of observations	4936		1491		20414	

Notes:

1: 80-85 : Time dummy variable taking the value one if the year of entry is between 1980 and 1985

2: Copenhagen area : Region dummy taking the value one entry is located in Copenhagen area

3: Share of highly educated : Proportion of staff with length of education corresponding to a university degree

4: Same industry : Dummy variable indicating whether the spin-off, pushed spin-off, or entry in FDS category is located in the same industry (at two digit level) as parent firm.

In estimating the duration model, we adopt a proportional hazard specification, *i.e.* we specify the instantaneous risk of failure at age t for a given entry *i*, given that it is alive at t, as

$$\lambda_i(t, x_{it}) = \lambda_0(t) f(\mathbf{x}_{it}, \boldsymbol{\beta})$$

where $\lambda_i(t, x_{it})$ is the hazard, specified as a function of age of the firm, t, the observed characteristics of the firm and its environment, collected in the vector $\mathbf{x}_{it}$, and a vector of coefficients $\boldsymbol{\beta}$. The hazard is specified as the product a baseline hazard function, $\lambda_0(t)$, which is time dependent and identical for all subjects, and a function $f(\mathbf{x}_{it}, \boldsymbol{\beta})$, which captures observed heterogeneity across subjects. The latter function is specified as $\exp(\mathbf{x}_{it}'\boldsymbol{\beta})$, that is, as an exponential linear function of a vector of covariates and their associated coefficients.

In our case, estimation is simplified by the fact that exit is recorded at discrete points in time, which allows us to express this duration model as a sequence of binary choice problems (Jenkins (1995)): firm *i* exits in some period *t* if $\mathbf{x}_{it}'\boldsymbol{\beta} + \varepsilon_{it} > 0$, where we specify ε_{it} to be i.i.d. extreme value distributed. This makes this model the discrete time equivalent to the continuous proportional hazard model outlined above (Prentice and Gloeckner (1978)).

The baseline hazard function is chosen to be of piece-wise constant type, *i.e.* the effect of the baseline hazard on the exit risk is allowed to change between time intervals chosen by the modeller, but is restricted to be constant within these intervals. This choice was determined by the desire to allow for flexibility of the model to include various forms of duration dependence, that is, flexibility with respect to how the exit risk changes over time. The piece-wise constant baseline hazard specification is implemented by including dummies for the age of the firm as additional explanatory variables.

The simple piece-wise constant baseline hazard model, with thresholds for the steps defined as {0,1,3,7,13,19 years} will be referred to as Model 1. Obviously, this model is unsatisfactory in a number of ways. First, the effects of the explanatory variables need not be constant over the life of an entry. This may especially be the case for characteristics of the entries at the time of entry, the importance of which is likely to dissipate or even disappear over time. For example, starting up as a

spin-off may well make a difference in the first years of the existence of a firm, but not after, say, twenty years. To open up for this possibility, we allow the relationships between a subset of the explanatory variables and the exit probability to change after three and six years, respectively. This extended specification is Model 2.

As another re-specification, we allow for the presence of unobserved heterogeneity in the model by introducing entry-specific random effects (frailties), which implies that the hazard function becomes

$$\lambda_i(t, x_{it}) = \theta_i \lambda_0(t) f(\mathbf{x}_{it}, \boldsymbol{\beta}) \quad ,$$

where θ_i is a random variable independent of $\mathbf{x}_i$ and distributed by some mixing distribution. We follow the notions in the literature that, given that the baseline hazard is flexible enough, the choice of this distribution is not so important. For computational ease, we follow Meyer (1990) and chose a Gamma distribution with mean normalized to one and variance σ^2 to be estimated along with the other parameters of the model. To sum up, the contribution of entry *i* that stays in the sample for T_i years to the likelihood function to be estimated is

$$LL_i(\boldsymbol{\gamma}_i, \boldsymbol{\beta}_i, \sigma) = \left[1 + \sigma^2 * \sum_{t=0}^{T_i - 1} \exp\{\gamma(t) + \mathbf{x}_{it}' \boldsymbol{\beta}\} \right]^{-\sigma^{-2}}$$
$$- \delta_i \left[1 + \sigma^2 * \sum_{t=0}^{T_i} \exp\{\gamma(t) + \mathbf{x}_{it}' \boldsymbol{\beta}\} \right]^{-\sigma^{-2}}$$

where δ_i is a dummy (indicator) variable being equal to one if firm i exits the sample by the failure event, and equal to zero if firm i exits as right censored. The baseline hazard function at time *t* is described by $\gamma(t)$. We estimate two models with unobserved heterogeneity. Model 3 restricts the frailties of the three different entry categorisations to follow the same common distribution, while Model 4 allows for different variances for each of the categories.

5.4 Estimation results

The estimation results are collected in *Table 7*, and can be summarised as follows. According to all models spin-offs have lower exit risks than the FDS entries. Simple Likelihood Ratio tests imply that Model 2 rejects the proportional hazard assumption of Model 1, and Model 3 rejects Model 2. In other words, unobserved heterogeneity is important, and should accordingly be controlled for.

Coefficient estimates of Model 3 and 4 are larger in absolute value than the estimates of Models 1 and 3; this is in line with the result that not controlling for unobserved heterogeneity, when present, tends to attenuate the magnitude of the coefficient estimates. As a consequence of controlling for unobserved heterogeneity, the negative duration dependence result of the first two models vanishes. When we restrict unobserved heterogeneity to follow the same distribution for the three categorisations, we find that the importance of the start-up categorisation decreases during the first three years, and stays constant thereafter.

Model 4 cannot reject Model 3 at conventional significance levels. However, the change in parameters, and the rejection of the test that spin-offs have the same frailty variance as the joint group of FDS and pushed spin-offs at the ten percent significance level (using an additional regression in which we imposed an equality restriction on the variances of the FDS entries and the pushed spin-offs groups, respectively) imply that we should base our further discussion of the results of Model 4. Turning from Model 3 to Model 4, the frailty variance increases for FDS entries (which implies a flatter estimated baseline hazard for this group) and decreases for spin-offs (which implies a steeper estimated baseline hazard), leading to an increasing gap in the risks between these categories. Allowing for different variances in the random effect implies that the result of converging risks disappears, *i.e.* the finding of convergence in risk between FDS entries and spin-offs implied by the unconditional Kaplan-Meier estimates and the results of Model 1 and 2 appears to be due to selection only. Instead, being started up as a spin-off is found to be as much an asset after seven years as it is in the first three years. Consequently, there must be initial conditions giving rise to highly persistent exit risk differences (Dunne et al. (1988), Lindholm (1994)).

The coefficient estimates are approximately equal to the percentage point changes in risk associated with changes in $\mathbf{x}$ (for some entry i with with θ_i=1), i.e. $\boldsymbol{\beta} = (\partial\lambda(.)/\partial\mathbf{x}(.))/\lambda(.)$. As the estimates of the entry categorisations obviously depend on the thresholds chosen to distinguish between the entry categories, we should be careful when interpreting the absolute values of the coefficients. Given the specific choices of thresholds, those entries categorised as spin-offs are found to have about a 50-60 per cent lower risk of failure than the base category. This difference is substantial, and there is no evidence that entries in the FDS category catch up the initial advantage of spin-offs.

Table 7: Duration Model Estimation: Results

	Model 1		Model 2		Model 3		Model 4	
	Coeff.	Std	Coeff.	Std	Coeff.	Std	Coeff.	Std
Baseline hazard function parameters :								
Step(1st year)[1]	-1.28 ***3	0.15	-1.24 ***	0.15	-0.56 **	0.22	-0.55 **	0.22
Step(2-3 yrs)	-1.59 ***	0.15	-1.56 ***	0.15	-0.62 ***	0.24	-0.60 **	0.24
Step(4-6 yrs)	-2.02 ***	0.15	-2.05 ***	0.15	-0.79 ***	0.26	-0.76 ***	0.26
Step(7-12 yrs)	-2.30 ***	0.15	-2.34 ***	0.15	-0.72 ***	0.28	-0.69 **	0.28
Step(13+ yrs)	-2.47 ***	0.15	-2.51 ***	0.15	-0.51	0.31	-0.48	0.31
Entry characteristics in year of entry:								
Number of employees	-0.06 **	0.03	-0.07 ***	0.03	-0.14 ***	0.04	-0.14 ***	0.04
(Number of employees)^2/1000	1.37	2.50	1.52	2.50	5.61	3.51	5.63	3.49
Ratio males	-0.07 *	0.04	-0.07 *	0.04	-0.06	0.05	-0.06	0.05
Mean age	-0.02 **	0.01	-0.02 **	0.01	-0.03 ***	0.01	-0.03 ***	0.01
(Mean age)^2/1000	0.16	0.12	0.16	0.12	0.27	0.17	0.29 *	0.16
Ratio highly educated	-0.61 ***	0.09	-0.61 ***	0.09	-0.75 ***	0.12	-0.76 ***	0.12
Copenhagen area	0.08 ***	0.02	0.08 ***	0.02	0.09 ***	0.04	0.10 ***	0.04
Industry dummies:								
Agriculture	-0.24 ***	0.04	-0.24 ***	0.04	-0.43 ***	0.06	-0.43 ***	0.06
Manufacturing	-0.16 ***	0.03	-0.16 ***	0.03	-0.23 ***	0.05	-0.23 ***	0.05
Transport	-0.15 ***	0.04	-0.15 ***	0.04	-0.27 ***	0.06	-0.26 ***	0.06
Finance	-0.14 ***	0.03	-0.14 ***	0.03	-0.25 ***	0.05	-0.25 ***	0.05
Services (except trade, restaurants, (	-0.54 ***	0.04	-0.54 ***	0.04	-0.78 ***	0.06	-0.77 ***	0.06
Time dummies; economic conditions:								
86-90	0.05 **	0.03	0.05 **	0.03	0.14 ***	0.04	0.14 ***	0.04
91-95	0.00	0.03	0.00	0.03	0.05	0.05	0.04	0.05
96-2000	-0.18 ***	0.04	-0.17 ***	0.04	-0.18 ***	0.05	-0.18 ***	0.05
Growth in GDP	-5.34 ***	0.66	-5.40 ***	0.66	-5.31 ***	0.70	-5.34 ***	0.70
Entry categorisations:								
Spin-off	-0.27 ***	0.04						
Pushed spin-off	0.03	0.05						
Same industry	-0.11 **	0.05						
Entry categorisations (time vaying coefficients):								
Spinoff(1-3 yrs)			-0.42 ***	0.06	-0.51 ***	0.07	-0.56 ***	0.07
Spinoff(4-6 yrs)			-0.07	0.09	-0.26 ***	0.10	-0.43 ***	0.14
Spinoff(7+ yrs)			-0.06	0.09	-0.31 ***	0.11	-0.60 ***	0.20
Pushed spinoff(1-3 yrs)			0.06	0.07	0.08	0.09	0.13	0.11
Pushed spinoff(4-6 yrs)			-0.01	0.12	0.02	0.14	0.15	0.24
Pushed spinoff(7+ yrs)			0.02	0.12	0.04	0.16	0.25	0.34
Same industry(1-3 yrs)			-0.17 ***	0.06	-0.19 **	0.08	-0.18 **	0.08
Same industry(4-6 yrs)			-0.04	0.10	-0.10	0.12	-0.08	0.11
Same industry(7+ yrs)			-0.04	0.10	-0.10	0.13	-0.09	0.12
Variance of mixing distribution:								
Sigmasq[2]					1.85 ***	0.21		
$Sigmasq_{Spin-off}$							1.23 ***	0.38
$Sigmasq_{Pushed\ spin-off}$							2.32 ***	0.60
$Sigmasq_{FDS}$							1.89 ***	0.22
Log(likelihood)	-33050.14		-33023.44		-32979.63		-32977.68	

Base categories (excluded dummies): construction, 81-85
All estimations are based on 26,841 entries in all industries except trade and restaurants in the period 1981-1999.
Notes:
1: Terms in brackets define the years since entry for which the coefficient applies
2: Sigmasq is variance of the random effect
*3: *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively*

We find that the positive effects of industry-specific intangibles are important only during the first three years. This indicates that FDS-entries are able to catch up with respect to these assets. Rather,

there seem to be other factors that generate the persistent differences, which may include: (i) the persons, who start up spin-offs know each other from having been colleagues and therefore start out with higher mutual trust and superior routines and work organisations, (ii) spin-offs face better conditions for raising capital or gain support from their parent companies, and (iii) spin-offs are generally based on better business ideas and strategies.

A word or two about the controls. There are large differences in the industry indicators. All industries have a lower exit risk than the construction sector. Notably, the services start-ups are characterised by low exit risk. Both the size and the age of the staff when launching the new firm are negatively related to the probability of failure in the relevant ranges of these variables. Entries with a relatively high proportion of employees with a university education perform better than the average entry in terms of survival. Firms located in the Copenhagen area have a higher exit risk. The entries in the sample are sensitive to changes in economy-wide conditions, a finding which is at odds with Boeri and Bellman (1995). A one percentage point drop in GDP growth increases the exit risk by 5.3 percentage points. We may note traces of cohort effects, suggesting differences in 'quality' of the entries at different stages of the business cycle. The quality of the entries seems to be higher during upturns and lower during recession years, which accords with our earlier characterisation of up- and down-turn entries as being pull- and push-determined, respectively.

Finally, it turned out to be important to distinguish between whether or not there is a strong push factor involved in the creation of the spin-off. Spin-offs, the parent firm of which died, do not according to our estimations have a lower exit risk than the comparison group. These differences in exit risks between spin-offs and pushed spin-offs corroborate the findings by Møen (2002) and Phillips (2002).

To obtain a notion of the robustness of the results, we re-estimated Model 3 with different thresholds defining the entry categorisations and specifying unobserved heterogeneity to be log-normally distributed, instead of Gamma-distributed. First, we categorised entries as spin-offs also when only thirty percent of the employees at the time of the entry had the same former firm affiliation, that is, we lowered this threshold to thirty per cent. The persistence in the exit risk differences between spin-offs and the FDS category remained unchanged. Moreover, this

specification suggests high persistence in the negative relationship between the indicator variable *Same industry* and exit risk[7].

As a second exercise, entries are only considered as spin-offs if the number of movers was less than thirty per cent of the staff of the incubator workplace. Again, the persistency result is unchanged, but now the *same industry*-dummy becomes insignificant for all entry ages. Finally, we also estimated Model 4 with a non-parametric frailty distribution following the Heckman-Singer (Heckman and Singer (1984)) approach, obtaining results very close to those in Table 7. In sum, we consider the results of persistency in the exit risk differentials as reasonably stable with respect to the exact specification of the model, whereas the results on the indicator variable *Same industry* should clearly be interpreted with due caution.

6 Conclusions

In this paper we have examined some aspects of the dynamics of spin-off start-ups using a large longitudinal Danish linked employer-employee data set. We categorise firm start-ups based on worker flows for the years 1981-2000, enabling us to follow new entries over extended time periods. We find fairly large differences between these categories both regarding their entry dynamics over the business cycle, and the patterns of later transitions and survival probabilities.

The spin-off activity is lowest in economic upturns, indicating that expanding firms are less likely to generate spin-offs. The finding of a high spin-off frequency in periods of stable economic growth is consistent with the hypothesis that a large number of spin-offs are created to exploit business opportunities. The high frequency of spin-offs observed in economic downturns is consistent with a large number of spin-offs being 'pushed' by crisis in the parent workplace rather than 'pulled' by the market. In short, no single explanation can account for the observed patterns.

However, when we take a closer look at the persons who start spin-offs and search for general incubator characteristics, it becomes clear that the spin-off activity is influenced by the economic

[7] However, in the first years, there is a decrease in the difference in exit risks for spin-offs operating in the same industry as their parents and those that do not.

performance of the parent firm, with weak sales growth being strongly and positively related to the probability of spinning off. This implies that spin-offs are mostly 'pushed' rather than 'pulled'. Another firm level factor which is positively related to the propensity to spin off is whether or not there has been a recent change of the CEO. The typical incubator firm is rather small. This could be interpreted as evidence of larger companies being better at containing career expectations and realizing business activities pursued by its employees. The persons behind spin-offs are older than other firm founders. A large proportion of founders of spin-offs has been employed in jobs in the upper echelons of the organizational hierarchy, or as specialists in the parent workplace, and is characterised by long job tenures at the parent workplace.

The group classified as spin-offs has a clearly lower risk of exiting from business than the reference group, starts-ups without any strong ties to a parent workplace in terms of former employees. In the estimated duration models that do not control for heterogeneity, we observe both negative duration dependence and rapid convergence in exit risks between spin-offs and entries from the FDS-group. Controlling for both observed and unobserved heterogeneity reveals, however, that these features are to large extent a result of selection. At the level of the individual firm, differences in exit risks are very persistent with spin-offs having substantially lower exit risks, even after more than seven years since the firm was founded.

Our analysis of the survival of the entries demonstrated that it is important to distinguish between whether or not there is a strong 'push factor' motivating the start-up of a spin-off firm, as the spin-offs, the parent workplace of which stopped its operations, are characterised by lower survival probabilities than the spin-offs where the parent workplace continued its operations. This supports earlier findings that the fate of spin-offs is closely tied to the experiences of the parent firm.

In general, entries started in times of slow growth in GDP have higher exit risk, even after controlling for growth in GDP as an additional explanatory variable.

Entries with a large proportion of employees originating from the same workplace appear to have a lower exit risk when the entry is within the same industry as the incubator, but it should be noted that this result hinges upon how we define spin-offs from the information on worker flows. For the initial choice of thresholds used for the categorisation of entries, the importance of industry-related

intangibles is suggested to decline after some years, which implies that some learning is taking place in the group of entries without any strong, common parent-firm background. A consequence of this finding is that other potential explanations may be needed if one wants to understand the persistent differences in exit risk between the entry categories.

In sum, the strength of the parent-progeny relationship in terms of worker flows does matter. The results of this paper corroborate some earlier findings of spin-offs being very successful firm entries even in the long run. Previous studies have not, however, been based on as comprehensive data covering as long time periods as those used in the current paper. In future work, we hope to be able to make use of information on the financial situation and ownership of the entry and of more information concerning the founders of the spin-offs - such as the job tenure at the parent firm or in the industry - in order to increase our understanding of the basic observations presented in this paper.

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