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Firm spin-offs in Denmark 1981–2000 — patterns of entry and exit

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Abstract

This paper adds 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 entrants, 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 entrant firms, which have less strong parent–progeny relationships in terms of worker flows.

JEL Classification: L11; L25; M13

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

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 organizational 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., Baldwin (1995), Bartelsman and Doms (2000), Bartelsman,

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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 because 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 entrant firms that has attracted a lot of attention in recent years is the 'spin-off', a term which describes entries whose impetus originates from within an existing company. These entrants 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 entrant. In addition, these entrants 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 the spin-off firms can draw on these intangible assets, they 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 (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 the entry and survival of spin-offs with between two and ten employees using a matched employer–employer data set on all Danish private sector firms during the period 1981–2000. The basic strategy is to categorize entrant firms by the worker flows associated with entry, and to compare the firm death risks across the categories. We have a large sample of about 42,000 entrants, of which 9000 are characterised as spin-offs, and can follow these entrant firms 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 initially are more successful, how long does it take for other entrants to catch up? It should be noted that the focus in this paper is exclusively on entrants spinning off from firms, i.e., corporate spin-offs, which distinguish this analysis from the literature on spin-offs generated by research institutions (see e.g., 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

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

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 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 2 years.

We find spin-offs to be associated with lower death risks than other entrant firms, 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 entrants. 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 organized 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, 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 are 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 adoption of the organization. This is emphasized by sociological studies of

[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.

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 of 513 Silicon Valley law firms, Phillips (2002) finds the strength of the parent–progeny relationship − as measured by the rank of the founder of the spin-off in the parent firm − to be positively related to subsequent survival probabilities of the entrants.

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 entrant firms 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 underlie firm creation and which could be used to categorize entering firms. They do, however, have valuable information on the origin of workers 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); see also Benedetto et al. (2004)).

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. For each year these employee records are linked to their employer by means of 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 categorized 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 previous 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 workplace (if existing) and the total staff of the entrant 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 entrants' subsequent transitions. As it is obviously not possible to make any distinctions into start-up categories based on worker flows for one-person entries, we restrict the sample of entrants to consist of new firms

[3] A problem with this kind of data is that integrated organizations may have been split up into different legal units. Occasional observations suggest that there are indeed large firms that 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 to constitute a problem for the present analysis, which concentrates on entrants with ten or fewer employees.

Table 1
Categorization of firm start-ups

	From different sources (base category)	Pushed spin-off	Pulled spin-off	Shift of id
50% or less of current employees came from the same previous workplace	Yes (33, 312)			
More than 50% of current employees came from the same previous workplace		Yes	Yes	Yes
More than 50% of employees at the previous workplace moved to the start-up				Yes (2, 333)
50% or less of employees at the previous workplace moved to the start-up		Yes	Yes	
The parent workplace survived			Yes (7, 027)	
The parent workplace did not survive		Yes (2, 144)		

with at least two employees in the first year of the firm's existence. This excludes 110,000 entrants from the sample.

We only consider entrants formed by persons with a close labour market attachment, and discard 32,000 entrants from the sample, for which the largest group of employees has not been employed in the year before entry.[4] For the resulting sample of small firms, we define four different entrant categories, which are presented in Table 1.

The categorizations are implemented as follows. We distinguish between whether or not the persons from the same former workplace make up more or less than 50% of total staff of the entrant (in the first year of existence). If the fraction is less than 50% (entrants 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".

A characteristic feature of spin-offs is that they have a strong connection to a former workplace, but are not business units that simply continue their operations under a new name. The first condition is captured by the requirement that at least 50% of the employees in the spin-off come from the same parent workplace,[5] the second is implemented by the condition that the movers are only a minor group – less than 50% 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.

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 entrants, for which spinning off is a survival strategy are henceforth called 'pushed spin-offs'. Correspondingly, we use the term "pulled spin-offs" for the case when the parent workplace continues its operations.

The number of persons moving from the parent to the spin-off is used as a proxy for the strength of the parent–entrant relationship. The category FDS differs from spin-offs in that this relationship is weaker than for the other spin-offs. Fig. 1 shows the distribution of the number of employees in the start-ups that originate from the same workplace. We may note that about half of the spin-offs start with employees all of which come from the same workplace. Note, that unlike in e.g., Klepper (2001), our definition of spin-offs does not include any condition that

[4] Initially, we observed a number of large start-ups (even up to several hundreds of employees). As these are most likely errors in the data, we imposed an upper bound of ten employees on the firm size of start-ups. This reduced the sample by about 9000 observations.

[5] Note, that it is *not* the firm. This distinction is of course important in the case of multi-plant firms.

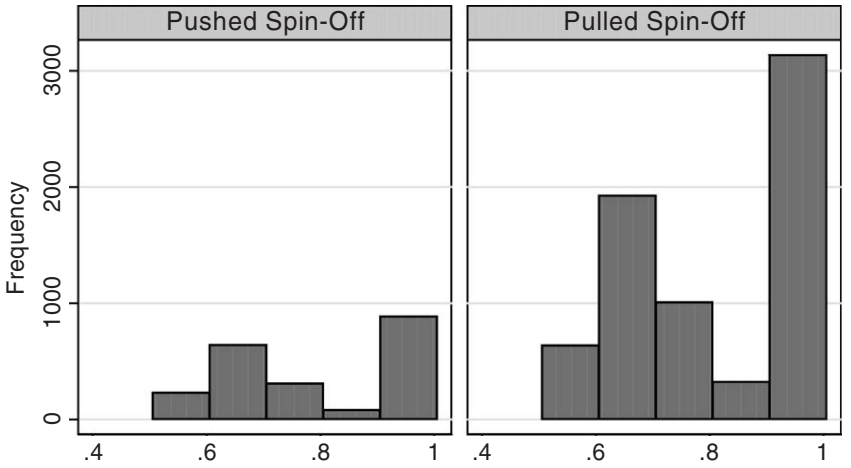

Fig. 1. Number of entrants by share of employees from same former workplace.

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 categorizations 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 sufficient 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 categorized as FDS. The volumes of these transfers are, however, generally larger in the group categorized as spin-offs compared to the baseline category.

The group of new firms in the data classified as 'Shift of id' comprises entire workplaces which are divested or firms which were mistakenly given a new identifier in the data, and which therefore

Table 2
Categorization of destinations

Destination	Right censored	Deaths	Split-ups	Other
The firm survives until year 2000	Yes (16, 174)			
The largest group of employees with the same destination is either unemployed or out of the labour force the year after exit		Yes (3, 665)		
The largest group of employees with the same destination goes to another firm and is less than or equal to 50% of the exiting firm			Yes (12, 010)	
The largest group of employees with the same destination goes to another firm and is more than 50% of the exiting firm				Yes (8, 459)
The largest group of employees with the same destination returns to the parent firm				Yes (14)
Data problems prevent identification of the destination of the employees				Yes (2, 161)

appear as new firms in the data. Entrants in this category are not in the focus of this assessment, and will be dropped from the sample in the following. Instead, focus will be on pulled spin-offs, pushed spin-offs, and FDS, as these form reasonable homogenous groups for comparisons. These categories comprise approximately 42,000 entrant firms in the period 1981 to 2000.

In order to track the subsequent histories of the entrants, we define, similarly to the entrant categorizations, four transition categories. These are summarised in Table 2.

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 categorizations 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 shortly be 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 Fig. 2 we can see that the pulled spin-off activity is lowest in times of economic recovery, while both recession and stable growth periods are associated with higher spin-off frequencies. A similar pattern is also observed for the FDS category. For spin-offs, the parent company of which dies, the movements are countercyclical up to the end 1990s, where their numbers increase despite continuous high economic growth. A more formal statistical analysis reveals that only the correlation between GDP growth and pushed spin-offs (-0.60) differs statistically from zero.

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 1990s.

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 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 pushed spin-offs in times of low GDP growth support the "push" explanation, while the increase in the late 1990s in a period of stable growth is more consistent with the "pull" story. A potential explanation 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.

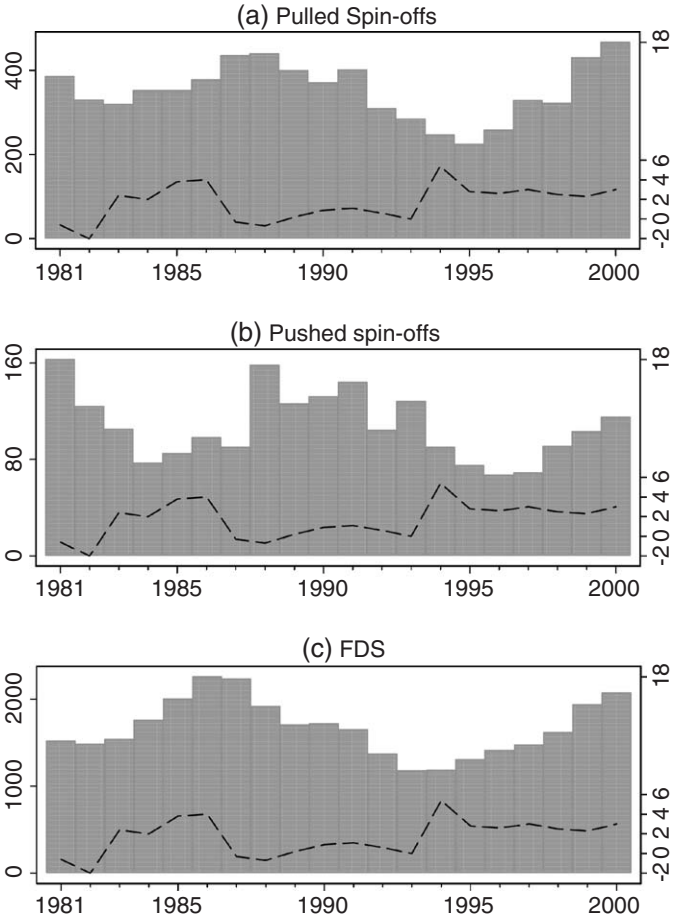

Fig. 2. Entry of FDS, pulled spin-offs, and pushed spin-offs; 1981–2000 GDP growth in pct on RHS scales.

4.2. Who spins off?

The persons behind spin-offs and other entries are of course a highly select group. Next we will shed some light on what characterises the individuals that start up spin-offs and other firm entries as well as the firms (the incubators) these employees originated from. To do this, we use, unlike the earlier literature, a fairly large sample of firms (the potential incubators) and all their employees.[6] The data at hand allow 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 this can be used in accounting for 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

[6] Note that this sample is different from the one used in the remainder of the paper which consists of a sample of firm entries.

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 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 self-employed*), 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 most recent year for which we have all relevant background information. The sample consists of about 2000 (mostly manufacturing) firms and about 600,000 employees.[7] Of these employees, 74% stayed with their current employer, 15.5% moved to another already existing firm, 7% moved to unemployment or dropped out of the labour market, 0.13% started a spin-off, 2.5 were 'divested', 0.4 started one-man firms, and 0.4% 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 and more highly educated, have stayed longer with their previous employer but have held a greater number of jobs, and are more likely to be from 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 are relatively uncommon in manufacturing.

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 estimated relative risk ratios 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 (the reference category). Highly educated employees are not. Unlike the other transitions, the probability to start up or join in a spin-off compared to staying is independent of age (the squared term included to pick up non-linearity is unimportant). Given the individual's age, her probability to take part in a spin-off 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 self-employed the number of previous jobs makes a difference. This makes sense insofar that the single entrepreneur needs general skills (Lazear, 2002), whereas this is less important when the new firm has several employees.[8] The same argument may be employed to explain the observation

[7] This is of course a selected sample, in which older, larger firms are over-represented. On the other hand, it covers a substantial part of private sector employment and is therefore more informative than previous studies which typically have been based on a single parent firm or only a few parent companies.

[8] Note, however, that the number of prior jobs also increases the probability of moving to other, new as well as old, firms.

Table 3
Mean values of personal and incubator characteristics by transitions 1997–98

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
Unemployment; 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 self-employed	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
Average of total sample	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	0.21	0.15
Go to 'old' firm	0.03	0.06	0.11	0.09	0.12	0.01	0.19	0.15	0.24
Unemployment; drop out	0.03	0.03	0.07	0.07	0.12	0.01	0.14	0.22	0.30
Start spin-off	0.07	0.13	0.18	0.11	0.07	0.01	0.20	0.07	0.17
Be divested	0.04	0.11	0.18	0.09	0.07	0.00	0.17	0.16	0.17
Become self-employed	0.05	0.05	0.09	0.08	0.13	0.01	0.17	0.13	0.30
Go to other new company	0.04	0.07	0.13	0.08	0.15	0.01	0.17	0.10	0.24
Average of total sample	0.05	0.07	0.14	0.09	0.08	0.01	0.20	0.19	0.17

Incubator characteristics: industry							Other incubator characteristics		
Transition	Manufacturing	Construction	Trade, hotels, etc.	Transport, communication	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
Unemployment; 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 self-employed	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
Average of total sample	0.51	0.08	0.28	0.04	0.07	0.01	6.66	1260.5	0.52

1: 'Highly educated' is a dummy variable taking the value of one if the length of education is 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.
3: The CEO is defined as the professional within ISCO 1210 with the highest salary; 'New CEO' is a dummy for CEOs who have had this job for less than 2 years.

Table 4
Relative risk ratios (RRR) from logit estimation of transition probabilities; reference category: transition 'Stay with present firm'

Transitions	Start spin-off		Go to 'old' firm		Unemployment; drop		Get divested		Become entrepreneur		Go other new firm	
	RRR	S.D.	RRR	S.D.	RRR	S.D.	RRR	S.D.	RRR	S.D.	RRR	S.D.
Personal characteristics												
Male	1.210**	0.109	1.130***	0.010	0.642***	0.008	1.306***	0.027	1.114**	0.053	1.022	0.051
Age	1.013	0.022	0.919***	0.002	0.806***	0.002	0.888***	0.004	0.882***	0.010	0.946***	0.013
Age^2	1.000	0.000	1.001***	0.000	1.003***	0.000	1.001***	0.000	1.001***	0.000	1.000	0.000
Higher education	1.002	0.156	0.933***	0.020	0.697***	0.030	1.218***	0.048	0.762**	0.105	0.959	0.113
Tenure	0.929***	0.022	0.837***	0.002	0.793***	0.003	0.969***	0.005	0.828***	0.013	0.855***	0.014
$Tenure^2$	1.002	0.002	1.006***	0.000	1.010***	0.000	1.001***	0.000	1.006***	0.001	1.004***	0.001
Number of prior jobs	1.022	0.025	1.037***	0.003	0.978***	0.004	1.012**	0.006	1.036**	0.016	1.072***	0.016
Executive	1.609***	0.277	0.889***	0.020	0.614***	0.021	0.990	0.047	1.046	0.114	1.033	0.127
Specialist	1.501**	0.236	0.812***	0.016	0.395***	0.014	1.314***	0.051	0.568***	0.065	0.896	0.096
Skilled	1.323**	0.172	0.831***	0.012	0.441***	0.011	1.305***	0.040	0.607***	0.050	0.890	0.071
Office worker	1.114	0.166	0.810***	0.013	0.538***	0.013	1.077**	0.039	0.615***	0.054	0.729***	0.066
Job in sales; services	1.002	0.172	1.149***	0.017	0.879***	0.018	0.829***	0.032	1.005	0.072	1.278***	0.097
Job in agriculture	1.200	0.550	0.953	0.049	1.228***	0.075	0.835	0.108	1.001	0.249	0.977	0.288
Job in crafting	0.993	0.126	0.831***	0.011	0.599***	0.012	1.060*	0.033	0.640***	0.043	0.797***	0.058
Other jobs	0.542***	0.090	0.786***	0.011	0.889***	0.016	0.972	0.031	0.645***	0.048	0.598***	0.051
Incubator characteristics												
Construction	2.019	1.438	1.179***	0.055	0.928	0.051	0.530***	0.053	0.490***	0.083	0.803	0.184
Trade, hotels, etc.	4.262**	3.056	1.423***	0.069	0.884**	0.052	0.554***	0.058	0.767	0.137	1.275	0.303
Transport, communication	3.027	2.154	1.212***	0.057	0.778***	0.043	0.914	0.091	0.593***	0.100	1.035	0.237
Finance, business activities	4.673**	3.380	1.624***	0.080	0.857**	0.053	2.818***	0.285	0.660**	0.126	1.278	0.314
Services	5.621**	4.018	1.375***	0.067	0.916	0.055	1.179	0.120	0.661**	0.121	1.041	0.249
Growth in sales	0.308***	0.063	0.655***	0.016	0.637***	0.023	0.650***	0.035	0.819	0.106	0.635***	0.085
Number of employees/1000	0.329***	0.032	0.803***	0.006	1.049***	0.009	1.479***	0.017	0.772***	0.031	0.747***	0.032
$(\text{Number of employees}/1000)^2$	1.097***	0.011	1.018***	0.001	0.995***	0.001	0.964***	0.001	1.022***	0.004	1.025***	0.005
New CEO	1.564***	0.116	1.008	0.008	1.057***	0.012	0.768***	0.013	1.040	0.043	1.096**	0.048

* 10 percent significance level.
** 5 percent significance level.
*** 1 percent significance level.

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

Start-up category	Exit category	Right censored	Death	Split up	Other	Total
From different sources (FDS)	Numbers	10,303	2064	7224	5214	15.181
	Percent	41.5	8.3	29.1	21.1	100.00
Pushed spin-offs	Numbers	727	133	401	438	1193
	Percent	42.8	7.8	23.6	25.8	100.00
Pulled spin-offs	Numbers	2645	263	1029	1286	3654
	Percent	50.6	5.0	19.7	24.7	100.00
Total	Numbers	13,675	2460	8654	6938	20,028
	Percent	43.1	7.8	27.3	21.8	100.00

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 of starting a one-man firm, while being employed at the executive level is suggested to increase the probability of both transitions.

The likelihood of spinning off is decreasing in the firm's sales growth and the size of the potential incubator firm. The two latter effects are substantially stronger than for other transitions.[9] 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. 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 next apply econometric techniques of duration analysis (see e.g., Lawless (1982), Kiefer (1988), and Lancaster (1990)) to examine determinants of the duration up to exit. The analysis is based on approximately 42,000 entrants in all industries.

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 5-year intervals, and only considers entries, which started before 1995. We may note that about 45% of the entrants survive the first 5 years. The group of start-ups categorized as 'FDS' has higher exit rates – either 'Death' or 'Split up' – than the pulled spin-offs and approximately the same exit rates as pushed spin-offs. As is clear from the table, there are considerable differences in the exit risks across different start-up categories. The remainder of this paper will focus on these in more detail, in particular with respect to the time dimension.

Turning to the timing of exit, we observe a high infant mortality rate and (before controlling for heterogeneity) a negative age–exit risk relationship. This is illustrated in Fig. 3 which displays the Kaplan–Meier estimates of the (unconditional) hazard functions. Exit rates are about 12% in the first year and about 4% in the long run which is in line with previous, comparable studies; see e.g., Baldwin (1995). Fig. 3 does not show any differences in the

[9] See Cooper (1971) for a discussion of potential explanations of why smaller firms have higher spin-off rates, and Wagner (2004) 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.

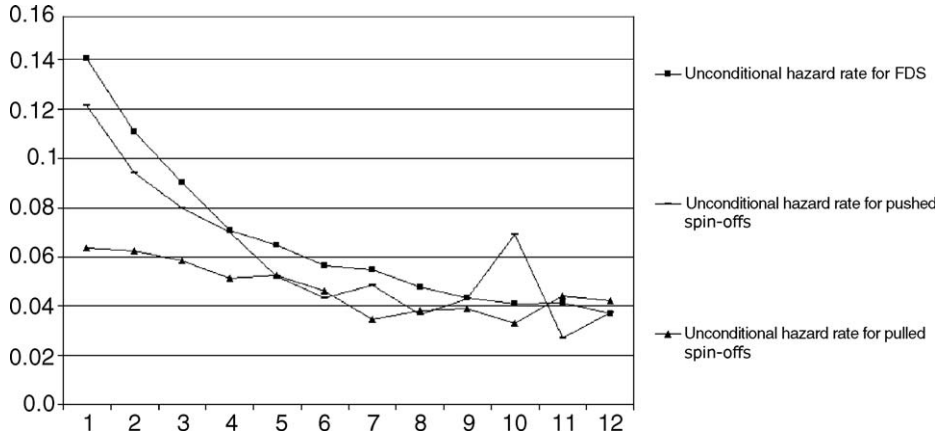

Fig. 3. Kaplan–Meier hazard rate estimates for entrants categories FDS, pulled spin-offs, and pushed spin-offs.

unconditional probability of exit between pushed spin-offs and the base category. On the other hand, the figure suggests that pulled 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%.

The convergence in exit rates of the FDS entrants and spin-offs, respectively, is consistent with two alternative interpretations. The first is that the FDS entrants, through 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 entrants implying that convergence is a result of sorting. Thus, after some years, so to say, only the fittest remain in the sample. Naturally, the entrants may differ according to a wide range of characteristics not captured by the entry categorizations, and these differences could explain observed differences in the hazard rate 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 categorization. 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 abovementioned observations remain unchanged.

5.2. The duration analysis

The choice of additional controls is largely determined by the variables available in the data set. We include the number of employees, industry dummies, time of entry dummies to allow for cohort effects, and a few characteristics of the individuals behind the entrant firm (all recorded at the time of the entry). The latter are mean age of the staff, fraction of male employees, and proportion of persons with a university degree education in the entrant firm during the year it started. For the entry categories ‘pulled spin-offs’ and ‘pushed spin-offs’, dummies for whether or not these entrants operate in the same 2-digit level industry as the parent workplace are included, too. This allows us to examine the role of industry-specific assets which are transferred to the entrant.

In addition to the variables described above, we included growth in GDP as an additional time-varying 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.

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

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

where $\lambda_i(t,\mathbf{x}_{it})$ is the hazard, specified as a function of time since entry, 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 the product of a baseline hazard function, $\lambda_0(t)$, which depends on time since entry and is 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 an exponential linear function of the 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 at age t if $\mathbf{x}_{it}'\boldsymbol{\beta}+\varepsilon_{it}>0$ t, 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 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 time period dummies as additional explanatory variables. Thresholds for the steps are defined as {0, 1, 3, 7, 13, 19 years}.

Table 6
Descriptive statistics

Variable	Pulled spin-offs		Pushed spin-offs		FDS/Base category	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Number of employees (in first year)	3.92	2.02	3.94	2.12	3.40	1.94
1981–85	0.26	0.44	0.25	0.43	0.25	0.43
1986–90	0.28	0.45	0.29	0.45	0.29	0.46
1991–95	0.25	0.43	0.21	0.41	0.20	0.40
1996–2000	0.21	0.41	0.26	0.44	0.26	0.44
Industry dummies						
Construction	0.18	0.39	0.13	0.34	0.12	0.32
Agriculture	0.03	0.16	0.02	0.14	0.06	0.23
Manufacturing	0.18	0.39	0.14	0.35	0.09	0.29
Trade, hotels, restaurants	0.30	0.46	0.30	0.46	0.39	0.49
Transport	0.04	0.21	0.05	0.22	0.06	0.23
Finance	0.16	0.36	0.21	0.41	0.15	0.36
Services	0.05	0.21	0.10	0.30	0.10	0.29
Copenhagen area	0.27	0.44	0.29	0.45	0.26	0.44
Share of males	0.67	0.33	0.65	0.34	0.59	0.37
Mean age	34.69	8.08	35.41	8.07	31.05	8.20
Share of highly educated	0.03	0.11	0.06	0.16	0.04	0.13
Same industry as parent firm	0.65	0.48	0.63	0.48	–	–
Number of observations	7027		2144		33,312	

Obviously, 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 entrant firms 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, 15 years. To open up for this possibility, in Model 1 we allow the relationships between a subset of the explanatory variables and the exit probability to change after 3 and 6 years, respectively.

In Model 2 we allow for unobserved heterogeneity by introducing entry-specific random effects (frailties), which implies that the hazard function becomes

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

where θ_i is a random variable independent of $\mathbf{x}_i$. We follow the practice in the literature that, given the baseline hazard is flexible enough, the choice of the distribution of $\boldsymbol{\theta}_i$ is less 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 entrant i that stays in the sample for T_i years to the likelihood function to be estimated is

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

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 $\gamma(t)$.

5.3. Estimation results

The estimation results are collected in Table 7, and can be summarised as follows. According to all models pulled spin-offs have lower exit risks than the FDS entrants. Likelihood Ratio tests imply that Model 2 fits the data better than Model 1. In other words, unobserved heterogeneity is important, and should accordingly be controlled for. As for the other coefficient estimates of Model 2, they are larger in absolute value than the estimates of Model 1. This is consistent that unobserved heterogeneity, when it is not controlled for, tends to attenuate the magnitude of the coefficient estimates. As a consequence of controlling for unobserved heterogeneity, the negative duration dependence result of the proportional hazard model vanishes.

Once we allow for heterogeneity, we observe considerably less convergence in risks. In fact, the equality restriction on the pulled spin-offs coefficients is not rejected by a LR-test (χ^2 (2 *df*): 4.44). In other words, the convergence in risk between FDS entrants and spin-offs implied by the unconditional Kaplan–Meier estimates and the results of Model 1 and 2 could well be entirely due to selection. This implies that being started up as a spin-off is as much an asset after 7 years as it is in the first 3 years. Consequently, as in Dunne et al. (1988, 2005) and Lindholm (1994) there are clear indications of initial conditions giving rise to highly persistent exit risk differences.

The coefficient estimates are approximately equal to the percentual changes in the hazard rate associated with changes in $\mathbf{x}$, i.e., $\boldsymbol{\beta} = (\partial\lambda(.))/\lambda(.)$. As the estimates of the entry categorizations obviously depend on the thresholds chosen to define the entrant categories, we should be careful when interpreting the absolute values of the coefficients. Given the specific choices of thresholds, entrants categorized as pulled spin-offs are found to have about a 50% lower risk of

Table 7
Duration model estimation: results

	Model 1		Model 2		Model 3		Model 4	
	Coefficient	S.D.	Coefficient	S.D.	Coefficient	S.D.	Coefficient	S.D.
Step (1st year)	−0.78***	0.10	−0.24	0.15	−0.26*	0.16	0.34**	0.17
Step (2–3 years)	−1.09***	0.10	−0.31*	0.16	−0.34**	0.17	0.28	0.18
Step (4–6 years)	−1.55***	0.10	−0.48***	0.18	−0.51***	0.18	0.27	0.20
Step (7–12 years)	−1.89***	0.10	−0.51***	0.20	−0.53***	0.20	0.16	0.23
Step (13+ years)	−2.05***	0.11	−0.34	0.22	−0.37	0.23	0.31	0.25
Number of employees	−0.08***	0.02	−0.15***	0.03	−0.14***	0.03	−0.27***	0.03
(Number of employees)^2/1000	2.66	1.92	5.81**	2.58	4.96*	2.69	15.26***	2.86
Share of males	−0.19***	0.02	−0.21***	0.03	−0.20***	0.04	−0.21***	0.04
Mean age	−0.03***	0.01	−0.04***	0.01	−0.04***	0.01	−0.05***	0.01
(Mean age)^2/1000	0.36***	0.08	0.42***	0.12	0.38***	0.12	0.44***	0.12
Share of highly educated	−0.49***	0.08	−0.59***	0.10	−0.64***	0.10	−0.59***	0.10
Copenhagen area	0.07***	0.02	0.08***	0.03	0.07***	0.03	0.08***	0.03
Agriculture	−0.28***	0.04	−0.44***	0.06	−0.45***	0.06	−0.41***	0.06
Manufacturing	−0.18***	0.03	−0.24***	0.04	−0.26***	0.05	−0.27***	0.05
Trade, hotels, restaurants	0.04*	0.02	0.03	0.03	0.02	0.04	0.00	0.04
Transport	−0.15***	0.04	−0.24***	0.06	−0.27***	0.06	−0.25***	0.06
Finance	−0.18***	0.03	−0.28***	0.04	−0.29***	0.04	−0.32***	0.04
Services	−0.62***	0.04	−0.84***	0.06	−0.83***	0.06	−0.86***	0.06
1986–90	0.03*	0.02	0.11***	0.03	0.11***	0.03	0.10***	0.03
1991–95	0.00	0.02	0.02	0.03	0.03	0.03	0.02	0.03
1996–2000	−0.19***	0.03	−0.20***	0.04	−0.20***	0.04	−0.19***	0.04
Growth in real GDP	−5.10***	0.51	−4.97***	0.53	−5.02***	0.54	−4.82***	0.55
Pushed spin-off (1–3 years)	0.01	0.06	0.03	0.07	0.05	0.09	−0.12**	0.05
Pushed spin-off (4–6 years)	−0.03	0.10	−0.05	0.11	−0.03	0.14	−0.34***	0.08
Pushed spin-off (7+ years)	0.04	0.11	−0.02	0.13	0.00	0.16	−0.10	0.09
Pulled spin-off (1–3 years)	−0.44***	0.05	−0.50***	0.05	−0.53***	0.06	−0.33***	0.04
Pulled spin-off (4–6 years)	−0.13*	0.07	−0.32***	0.08	−0.36***	0.09	−0.51***	0.07
Pulled spin-off (7+ years)	−0.10	0.07	−0.36***	0.09	−0.40***	0.10	−0.43***	0.08
Same industry (1–3 years)	−0.16***	0.05	−0.19***	0.06	−0.09	0.07	−0.46***	0.04
Same industry (4–6 years)	−0.03	0.08	−0.07	0.09	−0.06	0.11	−0.21***	0.06
Same industry (7+ years)	−0.08	0.09	−0.11	0.10	−0.11	0.12	−0.30***	0.07
Sigma^2			1.42	0.14	1.44***	0.15	1.45***	0.14
Number of observations (in firm years)	227.620		227.620		213.045		214.606	
Log (likelihood)	−54.815.18		−54.755.16		−51.974.83		−51.777.26	

* 10 percent significance level.
** 5 percent significance level.
*** 1 percent significance level.

failure than the base category. This is a substantial difference, in particular as there is no evidence that entrants in the FDS category to any significant extent are narrowing down the initial advantage of the pulled spin-offs.

We find that the positive effects of industry-specific intangibles are important only during the first 3 years. This indicates that FDS entrants are able to catch up with respect to these assets. Thus, there seem to be other factors generating persistent differences. These could 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 organizations, (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. The estimated industry differences are large. All industries have a lower exit risk than the trade, hotels, and restaurants sector and the construction sector (the reference category). The services start-ups are characterised by notably lower exit risks. Both the size and the age of the staff when launching the new firm are negatively related to the probability of failure. However, the impact is declining in size and mean age, as captured the quadratic terms. Entrants with a relatively high proportion of employees with a university education clearly perform better in terms of survival than the average entrant firm. Exit of entrants is relatively inelastic with respect to changes in economy-wide conditions, a finding which is in accordance with Boeri and Bellman (1995). A 1% point drop in GDP growth increases the exit risk by 0.05% (recall GDP growth is measured as a rate). For a hazard rate of, say 0.25, this would imply an increase in the exit risk of 0.25% 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 entrants seems to be higher during upturns and lower during recession years, which accords with our earlier characterisation of up- and down-turn entrants 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. The observed difference in exit risks between pulled and pushed spin-offs corroborates the findings by Møen (2002, 2005) and Phillips (2002).

To assess the robustness of the results, we re-estimated Model 2 with a different threshold definition. In Model 3 we define start-ups as spin-offs if 30% or less of the employees at the incubator workplace moved to the start-up. The persistence in the exit risk differences between spin-offs and the FDS category remained unchanged. Also the other estimates were unchanged except for the same industry dummy which now does not differ from zero in all time periods. In Model 4, start-ups are defined as spin-offs when at least 30% of their employees come from the same incubator workplace. Thus with this definition there is a weaker parent–progeny connection. The estimates differ more from Model 2 than Model 3 did, but in the main the qualitative conclusions remain the same except that now, not only pulled, but also pushed spin-offs have a lower exit risk than FDS start-ups. Thus, 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 for the "same industry"-indicator 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 categorize firm start-ups

based on worker flows for the years 1981–2000, which enables us to follow new firm entrants over extended time periods. We find fairly large differences between the different types of start-ups 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 performance of the parent firm, with weak sales growth being strongly and positively related to the probability of spinning off. This implies that a large share of spin-offs is mainly 'pushed' rather than 'pulled'. This is worth noting as pulled spin-offs are found to outperform pushed spin-offs as well other start-ups in terms of survival. 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 have been employed in jobs in the upper echelons of the organizational hierarchy, and are characterised by long job tenures at the parent workplace.

The group classified as pulled 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 pulled spin-offs and entries from the FDS-group. Controlling for unobserved heterogeneity reveals, however, that these features are to a large extent a result of selection. At the level of the individual firm, differences in exit risks are highly persistent with pulled spin-offs having substantially lower exit risks, even after more than 7 years since the firm was founded.

Thus, our estimation results lend some support to the active and passive learning models of Pakes and Ericson (1998) and Jovanovic (1982), respectively, which predict that entrants with superior knowledge about the industry-specific costs level and other factors will outperform the other entrants. The evidence also looks quite consistent with notions of the importance of intangible assets like personal networks (Helfat and Lieberman (2002)) and mutual trust within employee groups (Phillips (2002)). Finally, the success of spin-offs may be based on products with a high knowledge content (Franco and Filson (2005)) or products being suit-tailored to the market (Klepper and Sleeper, (2005)).

Our analysis of the survival of the entrants demonstrates 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 (e.g., Franco and Filson (2005)) and lends support to notions of organizational heritage.

In general, entrants started up in times of slow GDP growth have a 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 entrant 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 categorization of entrants, 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 entrant firms without any strong, common parent-firm background. Consequently, other explanations may be needed in order to understand the persistent differences in exit risk between the entrant categories.

In summary, 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 longer term. However, our results point to an important qualification: this pattern only exists for pulled, not for the pushed, spin-offs. Why there is a difference is not clear, but one element is presumably differences in the composition of the groups of movers behind the two types of spin-offs. Previous studies have not been based on 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 entrant firm 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 patterns presented in this paper.

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