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The effect of executive migration and spin-offs on incumbent firms

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Keywords: Spin-offs, Executive migration, Top employees, Performance.

Introduction

A great number of industry studies have illustrated, how employees leaving incumbent firms to found their own firm in the same industry are remarkably more likely to succeed compared to other *de novo* entrants.[1] While increasing attention is put on these spin-offs, there is almost no evidence of the effects spin-offs have on the parent firms (Phillips, 2002; Klepper, 2009). Phillips (2002), Pennings and Wezel (2007) and McKendrick et al. (2009) are notable exceptions. Using data on Silicon Valley law firms, Phillips (2002) shows that parent firms' hazard of exit initially rises when a high ranked employee leaves to found a spin-off. Similarly, Pennings and Wezel (2007) find that spin-offs increase the hazard of exit in Dutch accounting firms. Finally, McKendrick et al. (2009) find an initially negative effect on parent firms technological performance, but eventually this effect shifts and over time the parent firms experience a relative increase in technological performance compared to other incumbent firms.

Across these three studies, parent firms, at least initially, experience lower performance when employees found spin-offs. It is however still an open question, whether this result holds when the general migration of employees (e.g. to rivals) are controlled for. Only, Phillips (2002) accounts for this. These three studies are conducted on three specific industries. For accounting and law firms, it is intuitive that spin-offs are based on customer relations from the parent firm and this could be a convincing explanation for why spin-offs are harmful. But is this generally the case? McKendrick et al. (2009) find that the negative effect is only temporary and that parent firms are likely to perform better after the spin-offs have departed. But is this because stronger firms spawn more spin-offs?

Based on this evidence, we argue that it is still largely an open question whether spin-offs are generally harmful for parent firms and, if so, whether they are more or less harmful than losses of other top-level employees. We build on these studies and focus not only on the effect of spin-offs, but also migration to rivals and migration to other firms and other industries. The latter – migration to non-competing firms – is our baseline. If executive migration in general reduces the parent firms' stock of human capital and destabilizes organizational routines, the effect on parent firm performance might be independent on the reason for departure. This suggests that top employees' departure into spin-off entrepreneurship might not induce additional negative effects on parent firm

[1] For a recent review, see Klepper (2009).

performance. We use a unique dataset for Denmark to study the effects on 29,271 parent firms in a wide range of industries from 1993-2006. More specifically, we study the effect of top employee migration on future survival, sales growth and employment growth of the parent firm. Top employees are defined as employees placed among the top-25% wage-earners in the parent firm.

The decision to migrate could be endogenous to the past performance or expected performance of the parent firm. We account, at least partly, for this concern by matching the parent firms to each other based on observables and their performance history to study the effect of top employee migration in a more conservative setting. The matching models are estimated only for the cases where parent firms have one or zero departing top employees to isolate the effect of migration.

Our study adds to the literature on spin-offs and their effects as well as to the literature on the consequences and effects of executive migration and knowledge spillovers between rivals, incumbent firms and startups. Spin-offs are expected to bring relatively greater and more long-term welfare effects due to their superior performance compared to their peers, suggesting that industrial policy should encourage spin-off entrepreneurship (Gjerløv-Juel and Dahl, 2010). However, if there is a negative performance effect from parenting spin-offs, this is a more questionable strategy requiring more evidence on the effect on parent firms. The negative effect might be expected by parent firms leading them to try to prevent or resist spin-offs (Carnahan et al., 2010), maybe through non-compete covenants, which have been shown to decrease mobility and entry into entrepreneurship (Stuart and Sorenson, 2003; Marx et al., 2009).

Effects of migration on incumbent firms

Spin-off migration

It is widely recognized that new firms differ greatly in terms of performance. Spin-offs have often been highlighted as a particularly successful type of entrant (Agarwal et al., 2004; Klepper and Sleeper, 2005; Dahl and Reichstein, 2007b; Dahl et al., 2009). These are *de novo* entrants founded by previous employees from incumbent firms in the same industry. The establishment of a new firm is based on routines imprinted by the founder relying on prior personal experience to structure the new firm. Thus, the founders' experience is

of great importance to the performance of the new firm as organizational structures and behavior are transferred from parent to progeny (Sørensen, 1999; Klepper, 2001; Helfat and Lieberman, 2002; Phillips, 2002; Pennings and Wezel, 2007).

Explanations of the success of spin-offs typically rely on the argument that founders accumulate organizational and firm-specific knowledge at their previous employer (the parent firm), which enable them to outperform other entrants. This firm-specific knowledge could include knowledge about products, production, technologies, routines and structures, but could also include knowledge regarding strategy, markets and other processes, which might not directly conflict with intellectual property of parent firms (Cooper, 1985; Roberts, 1991; Shane, 2003). This capital is well suited if the new firm is established in the same industry. The founders' experiences in that particular industry gives him a head start compared to his peers (Agarwal et al., 2004) helping him to overcome the liability of newness (Stinchcombe, 1965).

Departing entrepreneurs might also take other resources with them to their own business. Former colleagues might be offered positions in the new venture. The parent firm risks losing personnel and firm-specific knowledge at the same time. In our paper, spin-offs are by definition established in the same industry as the parent firm. This implies that they potentially compete directly with the parent firm. Compared to other new rivals, spin-offs could pose a greater competitive threat, since spin-offs are based on knowledge, organizational routines and potentially also employees from the parent (Agarwal et al., 2004; Pennings and Wezel, 2007). This increases potential similarity in products, technology, markets or strategies. Thus, the departure of an employee to a spin-off should increase the hazard of failure for parent firms. This negative effect on the parent firm's performance should be greater, the greater the overlaps in products and markets between the parent and the spin-off (Phillips, 2002; Pennings and Wezel, 2007).

The departure of employees to spin-off entrepreneurship may not only decrease the parent firms' stock of human capital and increase competition; it could also disrupt organizational routines and increase the need for organizational restructuring (Phillips, 2002; McKendrick et al., 2009). When an employee resigns to entrepreneurship, his departure and subsequent replacement might trigger an organizational restructuring in the parent firm. This is more likely to be the case the higher the rank of the employee and the more important he is to the parent firm (McKendrick et al., 2009). Recent studies show that employees with longer educations, higher job performance and higher wages are more

likely to enter entrepreneurship, and more likely to succeed (Braguinsky and Ohyama, 2007; Groysberg et al., 2009; Elfenbein et al., 2010; Carnahan et al., 2010). If spin-offs are generally top employees, their departure might further increase the need for organizational restructuring and lead to decline in the parent firm's performance. It would also mean a greater loss of human capital to the parent firm.

The above arguments suggest a negative effect on the parent firm's performance following a spin-off. This drop in performance could stem from the loss of human capital and organizational change triggered by the departure of a top employee, which potentially destabilizes the organization (Hannan and Freeman, 1977,9; McKendrick et al., 2009). In addition, it could be an effect of the formation of a new competitor and the loss of knowledge, resources and social relations. In either case, we would expect spin-offs to have a negative effect on parent firms' performance.

Executive migration in general

While the above arguments suggest a negative performance effect from parenting spin-offs, we argue that these proposed effects from spin-offs might not differ from the effects of losing key personnel in general, e.g. to rival incumbent firms. This is important, since it questions whether the parent firms' apparent greater resistance toward spin-offs is rational or based on a fallacy. We argue that the answer depends on the actual mechanisms driving the effects. In the following, we hypothesize that the determining factor is whether the effects are mainly driven by i) organizational destabilization and loss of human capital, ii) increased competition triggered by loss of knowledge and loss of social capital (relationships), or iii) loss of intellectual capital (organizational routines) to rival companies.

Loss of human capital and organizational disruption

By definition, a top employee must possess high stocks of human capital, making him/her important (or even indispensable) for the company. For that reason, losing a top employee to spin-off implies a decrease in human capital and, potentially, a negative performance effect. However, this drop in the parent firm's stock of human capital is unrelated to the top employee's post-departure occupation. As a consequence, we should expect an equivalent performance drop following any top employee's departure. A similar argument can be made regarding the proposed increased need for organizational change, resulting

from executive migration (McKendrick et al., 2009). If either loss of human capital or organizational change drives the negative performance effects associated with top employees leaving for spin-off, we should expect similar effects when top employees leave for other reasons than entry into spin-off entrepreneurship (intentional discharge being the exception).

Increased competition

The above arguments build on the assumption that departing top employees equally reduce the parent firm's stock of human capital and trigger organizational change. However, if departures for spin-off in addition also increase competitive pressure, it could make spin-offs even more harmful than other types of top employee migration. This competitive threat emerges from transfer of knowledge (e.g. idiosyncratic knowledge regarding products, technologies and strategy) or transfer of social capital. We define the latter as loss of social relations, i.e. client and within-firm relationships (Corredoira and Rosenkopf, 2010). This loss of social relations happens when top employees are able to sustain customer relations upon departure. However, while this might increase competitive pressure on the firms parenting spin-offs, loss of social capital is also an obvious risk when top employees depart to rival incumbent firms. The same argument applies when departing top employees transfer intellectual capital from the parent firm to either a rival incumbent firm or to a spin-offs. This suggests that the proposed negative effects on parent firm performance from spin-off will be similar to the performance effects from migration to incumbent rivals.

In contrast, Pennings and Wezel (2007) argue that the loss and subsequent replication of parent firms' routines will induce more distinct competitive consequences if top employees resign to work at a newly founded firm (spin-off) as opposed to an incumbent rival. The reason for this is that new firms are not yet locked into a particular organizational structure and set of routines. No pre-existing patterns refrain them from adapting (or replicating) the best features of routines of the parenting firms. Incumbent firms, on the other hand, already have established organizational features, which are not readily altered or influenced by the new top employee (Schein, 1983; Dahl and Reichstein, 2007b; Pennings and Wezel, 2007). If spin-offs are imitating the organizational structure of their parents, it implies greater similarity in products and strategy, and hence competition for

same markets. I.e. they are competing for the same customers and resources, e.g. funding and employees. Therefore, this loss of intellectual capital might be more harmful in the case of spin-off.

On the other hand, while spin-offs are established in the same industry as the parenting firms, it is not evident that they will engage in direct competition with them. Nor is it certain that they will try to win the same resources. Cassiman and Ueda (2006) and Hellmann (2007) suggest that spin-offs exploit opportunities already rejected by the parent firms. This could open for potential synergies and mutual beneficial cooperation between the parent firm and the spin-off. If spin-offs complement their parents, rather than compete for the same markets, it might bring positive effects to parent firm performance. Moreover, potential positive effects to the industry from agglomeration, selection and legitimation might also suggest additional positive effects from spin-offs, if such positive industry effects would partly offset the negative effects on the individual firm. However, we expect that such positive effects of employee mobility will benefit the industry (or region) more than the individual firm (Baron et al., 2001).

In general, the departure of key personnel is not solely associated with losses to the parenting firms (e.g. loss of human capital). If these are replaced, the new employees also imply a potential inflow of new knowledge and social relations (Kaiser et al., 2008; Corredoira and Rosenkopf, 2010). This is a part of the organizational restructuring following the resignation of top employees, which could include a re-evaluation of managerial practices, a realignment of organizational structures or improved strategies. Implementing these changes in the organization might be a lengthy and troubling process. Nevertheless, we expect that any negative effects on parent firm performance following executive migration will decrease over time.

While top employees' departure into spin-offs entrepreneurship might be potentially harmful to parent firm performance, we argue that similar negative effects might be expected for executive migration in general, independent on the reason for departure. If either loss of human capital or organizational change drives the negative effects on parent firm performance, the proposed negative effects from spin-offs should not differ from the effects of other types of top employee departure. However, if transfer of knowledge and social capital from the parent to a potential competitor increase the competitive threat facing the parent firm, both departure for spin-offs and rivals are worse for the parent firm than departures to entrepreneurship in remote industries or to non-rival incumbents.

Furthermore, for spin-off entrepreneurship, imitation of the parent firm's organizational structure might increase similarity and hence competition, suggesting a relative stronger negative effect on parent firm performance. Finally, firm performance might be subject to opposite effects from top employee departure, especially when top employees depart to spin-off. Inflow of new knowledge and social relations, if the departing top employee is replaced, potential synergies between spin-offs and parent firms, and positive industry effects could partly offset the proposed negative effects of spin-offs and executive migration in general. In sum, the overall effects from executive migration in general, to spin-offs and rivals, depend on the relative effects from loss of human capital, social relations, knowledge and resources and organizational change and increased competition. The outcome is dependent on which of the above mechanisms are the stronger, and hence will drive the effects on parent firm performance.

Method

Data

We analyze the effect on parent firms' performance following spin-off and executive migration exploiting a linked employer-employee database for Denmark. The Danish Integrated Database for Labor Market Research (referred to by its Danish acronym, IDA) contains information on all employees and all firms in the economy from 1980 to 2007 and is maintained by Statistics Denmark. For a thorough description of this database and its use, see Timmermans (2010).

In our sample, we include all active incumbent firms from 1993-2006. Firms from the public sector and the heavily regulated primary sector are excluded because we expect other factors to affect firm performance in those sectors. To be considered active, a firm must employ a minimum of one full-time equivalent employee. Using this definition, we determine firm age as the first observed activity within an observation period starting in 1980. If a firm have less than one full-time employee for two consecutive years, we consider the firm closed. We allow for a single year without activity, but we do not allow for re-entry. Subsequent observations are dropped, giving us a a more conservative dataset. This gives us a sample of 196,839 firms.

We do not expect departures of all types of employees to have equal effects on the

performance of firms. Not all blue-collar workers have a measurable impact on a firm when they resign, and migration of lower wage worker might even increase firm performance (Carnahan et al., 2010). Therefore, we restrict ourselves to look at only top employees. Top employees are defined as full-time employees with a salary equal to or above the 75th percentile of full-time salaries in each firm.[2] Legal individual owner(s) and founder(s) are top employees regardless of their salary.

Parent firms are firms that lose one or more top employees during the period of investigation. The above argument implies that only top employees have the ability to affect parent firm performance. In smaller firms, however, this might be true for all employees independent of their salary. However, the latter does not match the objective of this analysis. Parent firms are restricted to those firms that employ a minimum of ten full-time equivalents at the time of resignation. In order for firms in the dataset to be comparable, we only include firms that have ten full-time equivalents or more in at least one out of two years from 1993-2007. This reduces our sample to 29,271 firms.

Depending on their post-departure employment, we divide the departing top employees into three categories: i) spin-off entrepreneurs, ii) employees at rival incumbent firms, or iii) other employment (e.g. entrepreneurs in other industries, employees at non-rival incumbent firms, retirees and students). A spin-off is a new business founded in an industry closely related to the industry of the parent firm (same four-digit SIC-code). Along similar lines, a departure to a rival incumbent firm is a departure to a firm within the same four-digit SIC-code industry as the parent firm.[3]

Identifying entrepreneurs and spin-off departures

There are two ways to identify entrepreneurs in the Danish data. There is an additional database with entrepreneurs that can be merged with the IDA. This database contains information on the main founder of new businesses in Denmark based on information on boards and registration that is not in IDA. The weakness of this database in our context is that it contains only one founder of each business. We could see other top employees leaving to found a firm as a team. As a result, we have chosen to rely on the

[2]We test our results' robustness to this threshold, estimating Model 1 - Model 14 using the 90th percentile as well. This does not alter our findings, indicating that our results are robust to alternative definitions. These estimations can be acquired upon request.

[3]Incumbent firms include firms of all ages except start-ups (firms aged zero).

IDA for the identification of entrepreneurs and spin-offs. More specifically, we adopt the approach of Sørensen (2007) with minor modifications. Statistics Denmark provides annual information on occupation of all individuals. We use this to identify the entrepreneurs behind all businesses with personal liability. This includes self-employed individuals with or without employees.

However, the occupation variable does not identify the entrepreneurs behind incorporated ventures. Therefore, using IDA, we further identify all newly founded firms in Denmark from 1981-2007, again in accordance with Sørensen (2007). Following the above criteria, entrepreneurial entry happens when a firm appears as a new employer. The first observation determines the start-up year and we drop all subsequent observations. Moreover, we exclude firms from the public and the primary sectors. We identify the founder(s) from the pool of individuals employed in the start-up year using the following criteria: (1) all employees present in a new firm if it has three employees or less. For firms larger than this, the decision criteria is: (2) founders are all individuals with the status of CEO or top manager, (3) when no one fulfills the former, founders are individuals with occupational code as wage earner on the highest level. We identify as much as five founders based on this criterion (selection is based on highest salary). (4) We open for an inclusion of individuals that are listed with unspecified occupation codes. Potentially, these individuals might be the rightful founders. We list these as founders if they belong to the top-3 paid employees. These may replace up to three individuals from (3). (5) If no one fulfills any of the four criteria, we treat the three employees with the highest salary as founders.

Explanatory variables

We follow McKendrick et al. (2009) concerning most of the explanatory variables of interest. Accordingly, we include a dummy variable for spin-offs. This variable takes a value of one in all years after an incumbent firm has had its first spin-off. If the last observation of the top employee at the parent firm is in year t, then the spin-off dummy takes the value one in this year and all of the following.

We also include a clock variable, counting the number of years since the last spin-off, to analyze how the effect of spin-offs evolves over time. This clock variable takes on the value zero in year t, value one in year $t+1$, value two in year $t+2$, etc. We reset the clock, each time an incumbent firm has a spin-off. By definition, this variable can be interpreted

as the number of years since the incumbent has had a spin-off. Theoretically, we expect spin-offs to have initial negative effects on parent firm performance. A negative effect from the spin-off dummy variable will confirm this hypothesis. However, we expect this effect to diminish over time as a positive effect from the spin-off clock variable in the regressions.

As argued above, we account for the effect of departures of top employees in general and top employees departing to rival incumbent firms. For each, we introduce two equivalent variables: a dummy for departures and a clock variable for time since most recent departure. The former, executive migration in general, accounts for the departure of all top employees, including entry into spin-off entrepreneurship and departures to rival incumbent firms.[4] We expect an initial negative effect on performance captured by our top employee departure dummy, but eventually we expect incumbent firms to recover from their loss, as captured by a positive clock-variable. If spin-offs have no additional effect on firm performance, when controlling for the migration of top employees in general, the above spin-off variables will be insignificant. The same holds for departures to rival incumbent firms.

Carnahan et al. (2010) hypothesize that, conditional on mobility, top employees are more likely to enter entrepreneurship. Entrepreneurship offers a direct link between individual performance and pay. This might attract high-performers seeking to improve their earnings (Carnahan et al., 2010; Elfenbein et al., 2010). We tested this hypothesis on our dataset. Conditional on mobility, we find that top employees departing for spin-offs are more likely to be in the upper percentile of the top 25% wage earners in each firm.[5] To

[4]Notice, there is no overlap between the two variables, "departure to spin-off entrepreneurship" and "departure to an incumbent rival firm". Spin-offs are only treated as newly founded firms during the start-up year. The above criteria identify the founders. Executive migration in subsequent years to the spin-off is treated as departure to an incumbent rival firm.

[5]We test the hypothesis estimating a negative binomial model (results are available upon request). The dependent variable is the wage score as described below. We include 4,671,045 observations of top employees from 1993-2006, including 606,812 departures. We include controls for: age, age squared, tenure, tenure squared, work experience (logged), education (years), gender (dummy for male), children (dummy for children age 0-12). Moreover, we control for firm characteristics: industry (dummy for each two digit SIC-codes, 41 categories), legal form (dummy for unlimited liability), year dummies, labor market region dummies (77 categories), size (number of full-time equivalents, logged), top employees (number of top employees, logged) and dispersion in compensation structure (difference between the 75th and 100th percentile salary, logged). We find a small negative effect on wage score from top employees departing in general. This indicates that relatively higher salary reduces the likelihood of departure. Conditional on mobility, we find that top employees departing for spin-offs have a higher wage score. We also find a small positive effect from top employees departing for rivals.

control that an additional adverse impact from spin-offs is not driven by the loss of above average human capital, we control for the departing top employee's rank in the firm. We give top employees a wage score between zero and ten based on their relative salary. In continuation hereof, we expect the decision to enter entrepreneurship to be linked with the market structure.

In general, entry rates are higher during entrepreneurial regimes where entry barriers are low (Klepper, 1996; Agarwal et al., 2002). If motivated by the prospect of improved earnings, top employees might be more likely to depart for spin-offs when market concentration is low and economic profits exist. This might result in a smaller negative performance effect from departures for spin-off compared to top employees' departure to rival incumbents in more competitive markets. Moreover, market concentration affects firm performance independently of executive migration. Therefore, we further control for industry concentration. We measure industry concentration using the normalized Herfindahl index (41 industries) (see e.g. Hall and Tideman (1967)).[6]

In addition to the covariates described above, we include controls for firm age (logged), size (number of full-time equivalents, logged), size group (discrete variable, three categories after the number of full-time equivalents in the majority of years from 1993-2007), industry (dummy for each two digit SIC-code, 41 categories), legal form (dummy for unlimited liability), wage level (average gross wage level of CEO, white collar and blue collar workers, respectively (all logged))[7], year dummies, GDP growth (yearly growth rate, percent) and, finally, labor market region dummies (77 categories). Descriptive statistics are presented in Table 1.

Estimations

We use three performance measures: firm failure, growth in sales and growth in employment. We investigate the effects of executive migration on survival of the parent firms using the exponential survival model (accelerated failure-time form). I.e. we estimate time to failure (t_i), assuming that $\tau_i = e^{(-\beta_1 x_{1i,t} + ... + \beta_k x_{ki,t})t_i}$ is exponential (Cleves et al.,

[6]The Herfindahl index range from 1/N to 1. We normalize it to range from zero to one.

[7]Missing values (as not all firms have employees in all categories) are replaced with the industry average.

2004):

$$ln(t_i) = \beta_1 x_{1i,t} + ... + \beta_k x_{ki,t} + ln(\tau_i) \quad (1)$$

We study the effects on sales and employment following the approach used in Sørensen (1999). Accordingly, we express growth as a function of firm size (S) and a number of covariates (x), where size is total sales or total number of full-equivalent employees:

$$ln(S_{i,t+1}) = \alpha \ln(S_{i,t}) + \beta_1 x_{1i,t} + ... + \beta_k x_{ki,t} + \epsilon_{i,t+1} \quad (2)$$

Following McKendrick et al. (2009), we estimate population-averaged effects using Generalized Estimation Equation (GEE) regressions, which take within-group correlation in panel data into account (Zenger et al., 1988). The minimum requirement of the model is two subsequent observations, i.e. single firm observations are excluded from the estimations. Correlation within firms is treated as autoregressive (AR1). Using the Huber/White/Sandwich of variance, the estimation produces semi-robust standard errors. The dependent variable is continuous (assumed to be normally distributed). The GEE Panel regression uses *ln(sales)*$_{t+1}$ and *ln(full-time equivalent)*$_{t+1}$ as dependent variables, respectively. Both sets of models include the lagged value of the dependent variable as given in Equation 2. Data limitations restrict the observation period to 1995-2005, when estimating *ln(sales)*$_{t+1}$. Except from the size and age variables, both models of firm growth include the same set of covariates as the firm survival model.

Finally, when investigating the effect of executive migration on firm growth, our estimates might be subject to a selection bias, as firms exit the population. We could be experiencing this for firms exiting that would have been among the lowest performing firms in the population, potentially due to migration of top employees. To control for this potential selection bias, we further estimate Heckman selection models. Thus, for our sample, the likelihood of observing a given firm in the sample is equivalent to the likelihood of that firm having survived. Following Hall (1987), we approximate the likelihood of survival using the employment growth rate from time $t-1$ until t (as defined by e.g. Haltiwanger (2009)), when estimating *ln(full-time equivalent)*$_{t+1}$. Correspondingly, we include the sales growth rate as our instrument variable, when estimating *ln(sales)*$_{t+1}$. We estimate the latter using limited-information maximum likelihood (two-step method)

and we use full-information maximum likelihood for *ln(full-time equivalent)*$_{t+1}$ (see e.g. Puhani (2000) or Chiburis and Lokshin (2007)).

Results

Firm survival

Table 2 presents results from exponential survival models estimating the effect from spin-offs and executive migration on *ln(time to failure)*. The estimations are based on 214,482 firm-years from 1993 to 2006 for 29,271 unique incumbent firms. All models include size group, industry, region and year dummy variables as well as unreported controls for GDP growth.

Model 1 presents the effects of general top employee departure on survival. We find that having at least one top employee departure from the firm has a significant, negative impact on survival, but the effect wears off over time. A higher wage score increases the negative effect. Losing a top employee with the average wage score 5.49, decreases the expected time to failure with 47.3% and each subsequent year increases survival time by 5.2%. This means that it is in general negative to lose top employees independent of where these employees go. In general, large and incorporated firms have greater survivals. We also find that firms in less competitive industries and firms with higher wage levels for white collar and CEOs have greater survival chances. Model 2 looks at the effect of top employees departing to become spin-offs, i.e. enter the same 4-digit SIC industry as entrepreneurs. This also has negative effects on survival of the incumbent firm.

The negative effect of losing a top employee to a potential competitor (spin-offs) is also found for cases, where the top employee leaves for incumbent rivals. This is shown in Model 3. If a firm loses a top employee to an incumbent in the same 4-digit SIC industry, it has a negative and significant effect on the survival of the firm. As seen for top employees in general, this effect is reduced over time. In our final model, we test the effect of these types of executive migration in the same model. Thus, we examine the effect of these while controlling for other types and the general departure of top employees (Model 4). We find that after controlling for general departures of top employees and departures to rivals, the effect of spin-offs is insignificant. Spin-offs (of top employees) do not have any significant effect on the survival of the parent firms, if we control for

general migration of top employees. In contrast, we find that top employees departing for incumbent rivals have a significant and negative effect on survival. Top employees migrating to rivals reduce the time to failure by additionally 18.6% compared to executive migration in general. This result suggests that top employees who resign to work for rival incumbent firms have relative larger negative effects on firm performance compared to top employees who depart for spin-off entrepreneurship, the latter being no more harmful than executive migration to non-competing firms. This might question the competitive threat facing the parent firm from departure to spin-off entrepreneurship.

Firm growth

Table 3 presents results from GEE panel regression estimating the effect from spin-off and other types of executive migration on $ln(sales)_{t+1}$. The estimations are based on 146,921 firm-year observations from 1995 to 2005. This is based on 22,004 firms. All models include size group, industry, region and year dummy variables as well as unreported controls for GDP growth.

Overall, the estimates of migration on sales in the following year support the findings from the survival models. We find that departing top employees have a negative and significant effect on sales independent of where they are active afterwards (see Model 5). The effect of this is again reduced over time. Top employees that leave as spin-off entrepreneurs, founding a new firm in the same industry, also have a significant and negative effect on parent firms' sales (see Model 6). Again, an effect that is significantly reduced over time. We also find that top employees leaving for incumbent rivals have a significant and negative effect on the sales of the parent firms (see Model 7). This effect also wears off over time.

When we add these three types of top employee migration to the same model (Model 8), we find that top employees departing for spin-offs and for incumbent rivals have negative effects on the sales of the parent firm after controlling for the general departure of top employees. Departure for spin-offs and rivals reduces sales by additionally 1.6% and 2.7%, respectively. These effects do not differ significantly. This indicates a similar increase in the competitive pressure from departures to both spin-offs and rivals.

Aggregating the effects from migration in general, spin-off and wage score (average is 6.19 for spin-offs), we find that having a top employee departing for spin-off, reduces

sales by 12.7%. Similarly, departure for rivals reduces sales by 13.5%, while executive migration in general only reduces sales by 10.8%. The effects diminish by 0.4% per year for all departures and additionally 0.3% per year for both spin-offs and rivals. The latter suggests a relatively faster recovery, when top employees' resign for spin-offs or rivals. In the last year of the observation period (after 13 years), the model indicates a reduction in parent firms' sales of 5.6%, 3.6% and 4.6% for migration in general, to spin-offs and rivals, respectively.

Controlling for selection bias, we estimate $ln(sales)_{t+1}$ using the Heckman selection model (see Model 9). The model shows a positive selection bias, confirming our expectation. I.e. selection is associated with higher performance, as weaker firms exit the population. In general, the model supports previous findings. For the additional effect on parent firm sales growth from spin-off, however, statistical significance is weak. Again, this indicates that a top employee's departure to a rival incumbent firm is more harmful to parent firm performance compared to departure into spin-offs entrepreneurship. We test these findings against another dependent variable, employment growth in the year after the departure of one or more top employees. Table 4 presents results from GEE Panel regression estimating the effect from spin-off and executive migration on $ln(full\text{-}time\ equivalents)_{t+1}$. The estimations are based on 228,149 firm-year observations from 1993 until 2006 based on 27,226 unique firms. All models include size group, industry, region and year dummy variables as well as unreported controls for GDP growth. The regressions on firm growth are almost identical to the previous findings (see Model 10-13). We find that top employees founding spin-offs have a negative and significant impact on the future employment growth of the parent firm. At the same time, we see that departures of top employees to rivals and other destinations have negative and significant effects as well. All three effects are significantly reduced over time.

Again, we control for selection bias using the Heckman selection model (see Model 14). The selecting model supports the conclusions of Model 13. Executive migration has a negative effect on parent firm employment growth. This negative effect increases when top employees depart for either spin-off or incumbent rivals. The additional negative effects on parent firm performance from spin-offs and rivals do not differ significantly.

Endogeneity

Our results illustrate a negative effect of losing top employees in general, to spin-offs and to rival firms. It is a natural question whether these effects are found because incumbent firms losing top employees are different from other firms. Do we see this effect because the top employees leave declining firms or firms with dark futures ahead of them? This hypothesis has been labelled *the sinking ship hypothesis*. However, for spin-offs in particular, this hypothesis goes against the majority of the spin-off literature (Klepper, 2007; McKendrick et al., 2009). Here it is typically found that the most successful parent firms also have the largest number of spin-offs. One argument is that employees at successful firms are more exposed to unexploited (or underexploited) opportunities (Agarwal et al., 2004). Moreover, working at a successful firm might be a stamp of approval, making it easier for the spin-off entrepreneur to e.g. raise capital and attract the most talented employees (Dahl and Reichstein, 2007a). Franco and Filson (2006) even suggest that potential entrepreneurs might accept a lower wage for "apprenticeship" at a successful parent firm. This means that we should find more spin-offs in the firms that have had the highest growth rates in the past years.

In general, high growth might increase the need for organizational restructuring. If organizational changes alter an organization's blueprint, it might increase employee turnover (Baron et al., 2001). Moreover, top employees might be in a more favorable position to find alternative employment (or will receive more job offers), when employed in more successful firms. This suggests that parent firm performance is associated with higher rates of top employee migration. On the other hand, economic theory suggests that wage difference is an important mechanism for the allocation of labor among firms. More productive firms can pay higher salaries and hence attract the most talented employees. If parent firms are more successful, we would expect them to compensate top employees financially to prevent their departure. However, other studies that use the Danish database find a strong positive effect on employee salary from changing employer (see e.g. Dahl and Klepper (2008) and Dahl et al. (2009)). This indicates that employees (in Denmark) are forced to resign to a new employer in order to earn a high increase in salary, rejecting this hypothesis.

Finally, endogeneity might also be associated with top employee heterogeneity, if top employees departing for spin-offs and rivals are different from other top employees. As argued above, high-performers might seek to improve earnings through migration e.g.

into spin-off entrepreneurship. This indicates that the stronger negative effects on firm performance from spin-offs and rivals could be driven by higher human capital among these top employees. We test these hypothesis below.

First, we estimate negative binomial regressions on the number of top employees departing in each of the three categories. We control for the employment growth in the past three periods before the departure of top employees. Additional controls are GDP growth, wage levels, limited liability and size (logged) as well as dummy variables for size, industry, region and year.[8] We find that growing firms have a larger migration of top employees in general, to rivals and as spin-offs. A one standard deviation increase in employment growth one year prior to departure, increases the number of top employees departing to spin-offs and rivals by 0.1 and 0.03, respectively. The same holds for large firms as well as in years with greater GDP growth in the economy. Overall, this means that we can reject *the sinking ship hypothesis*.

Second, to test the effect of potential endogeneity on our results, we supplement the above with a matching approach. This ensures that firms (and top employees) are completely comparable in the point of origin – the time of top employees' departure; in general, to rivals and as spin-offs. Table 5 illustrates this. Using nearest neighbor matching, we match firms on their ex ante performance, i.e. employment (logged), sales (logged) or survival (estimated). Moreover, to adjust for parent firm heterogeneity, we match firms on size group (three categories), industry (41 categories), firm age and average gross salary for blue collar workers, white collar workers and CEOs, respectively. These variables all refer to the last observation before departure, time $t-2$ (see Tabel 5). We estimate similar matched models to adjust for top employee heterogeneity. We match top employees on wage score (0-10), tenure, education (years) and age. Moreover, we match firms on ex ante performance, size group (three categories) and firm age.

We apply a very conservative design. We do not allow for collective or repeatedly migration. First, we restrict the sample to those firms that experience only a single departure within a five-year window. I.e. no other top employees are allowed resignation two years prior and two years after this event (see Tabel 5). The firms satisfying these criteria are matched with a sample of firms that experience no top employee departures within a five-year window. We refer to the latter as "controls". In every case, we match

[8] Estimations are available upon request.

the two groups based on performance and firm characteristics at time $t-2$. Then we compare performance of the "treated" and the "controls" at time t, two years after a potential departure. We match each "treated" with the two nearest controls.[9] Table 6 describes the categorization into different groups of treated and controls.

We estimate the effect of migration comparing employment (logged) and sales (logged). Furthermore, we estimate the mean survival time for each firm using Model 4 in Table 2. Estimating the effect on survival, we use both a five-year-window and a three-year-window. However, when using the five-year-window, the sample is conditional on survival, as we only include firms that survive until time t. This is the case for both the "treated" and the "controls". Then we compare the estimated mean survival time at time t. Matching firms from the two samples, we only match on their expected survival at time $t-2$. Using the three-year-window, we also compare the estimated mean survival time at time t. However, if a firm exits on or prior to time t, we replace the dependent variable value with -1 and 0 for firms exiting at time t and $t+1$, respectively. For the latter, we include all matching variables (e.g. firm size, age and industry).

Following the above order, we first investigate the effect of executive migration in general. This gives the baseline effect. Then, we estimate the effect of spin-off. We match firms with one top employee departing for spin-off with other single top employee departures (see Table 6). Following a similar procedure, we estimate the effect of departure to rivals. Furthermore, the matching approach permits a direct test for differences in effects from departure for spin-offs and rivals. Investigating the effect on employment (logged), sales (logged) and survival (three-year-window), we estimate matched models accounting for firm heterogeneity and top employee heterogeneity, respectively. When estimating the effect on survival (five-year-window), we only include one set of matched models, as we only match firms on their expected survival at the time of top employee departure.

First, we estimate the effect of one top employee who departs independent of the post-departure occupation. We no longer find a significant effect on employment growth from migration in general (see Tabel 7). However, the negative effects on sales and survival remains significant. Second, we match departures to spin-off with migration in general (but not including departures to rivals). We find a negative effect on both employment and

[9] Using a single match approach, might be relying on too little information. On the other hand, using too many matches, there is a risk of incorporating non-similar observations (Abadie et al., 2001). For these reasons, we use two matches as standard.

sales. On average, losing a top employee to spin-off entrepreneurship decreases employment by six percent and decreases sales by nearly twenty percent, relative to migration in general. Tabel 7 further indicates a negative effect on survival. However, this effect is barely significant. When matching primarily on top employee characteristics, we find similar results. The models for departure to rivals also confirm our previous findings. However, the effect on employment and sales are smaller than for spin-offs. On the other hand, we find a stronger negative effect on survival from departure to rivals.

The above findings suggest a larger effect from spin-off on employment and sales relative to rivals. Moreover, it indicates that departure to rivals has a greater effect on parent firms' survival. Matching spin-offs and rivals, however, we do not find clear evidence that the effects on parent firm performance differ between departures for spin-offs and rivals. However, a small indication is made, that spin-offs are more harmful to parent firms' sales.

We have shown that top employees' departing for spin-offs or rivals have larger negative effects on parent firm performance than other types of executive migration. Moreover, we have argued that the loss of social relations could be one of the mechanisms that drives this result. However, these network effects do not apply equally to all industries. We expect the effect from loss of relationships to be especially strong within certain consultancy industries, e.g. accounting or law firms as investigated by Pennings and Wezel (2007) and Phillips (2002), respectively. These are industries where decisions on business relations are more closely related to single individuals rather than companies. Investigating this in more detail, we have estimated the matched models (adjusted for firm heterogeneity) excluding all but the consultancy industries.[10] We find that the effect on survival from executive migration is larger within the consultancy industry. On the other hand, we find no effects on employment and sales within the industry.[11] The above arguments suggest that top employees' departure to rival incumbent firms and spin-offs, in particular, are

[10] Limited by the level of detail in the data, we only include industries where we believe that network-effects play a significant role. I.e. industries where the majority of activities match our definition of consultancy. We argue that this is the case for: law firms, accountancy and technical consultancy. Alternatively, the definition might also include e.g. financial institutions and insurance companies. However, we exclude these, questioning the degree to which costumers' preferences relate to single individuals. We argue that customers – large business clients in particular – are less likely to respond to a top employee turnover by changing their bank connection as compared to e.g. technical consultancy.

[11] However, matching departures from consultancy with departures from other industries, we find a strong effect on sales. I.e. departure from consultancy reduces parent firms' sales by 39 percent relative to migration within other industries, strongly supporting the hypothesis.

relatively more harmful within in the consultancy industry. Supporting this hypothesis, we find indications that departures for spin-offs and rivals have an above average adverse impact on parent firm survival. However, we find no significant effects with respect to employment and sales.[12]

Overall, the matched models support our previous findings. However, it is important to emphasize that this analysis is not directly comparable with the former (see Tabel 2 - Tabel 4). As the matching approach requires that there is only a single departure (or none) within a five year period, the estimates are biased toward the smaller firms in the population. For this reason, the previous analysis is necessary to obtain a more accurate picture of how migration affects parent firm performance. Therefore, the matching approach should be treated as a supplement to the previous analysis as well as a control of potential endogeneity. We investigate the impact of potential endogeneity in more details below.

The endogeneity problem can be regarded as an omitted variable bias. Our dependent variables might be related to unobservables before the resignation, e.g. strategic decisions and innovations. We can not observe all relevant information and we lack suitable instrument variables. We can never be certain on the degree of selection on these unobservables. However, Altonji et al. (2005) offer a method that demonstrates how sensitive our results are to these. Their approach allows assessing both the direction and magnitude of this bias. Combined with the estimated effects of our key-variables (the departure of top employees in general, to spin-offs and rivals) it establishes that the effect is within a defined range when controlling for bias.[13] Our primary concern is to establish whether our conclusions stand the test, i.e. if our estimates remain negative when we correct for the bias. Secondly, we wish to asses the severity of the bias and hence endogeneity.[14] We find that the bias is positive for the three types of executive migration. We subtract the estimated bias from the coefficient estimate to obtain the range, which we expect will include the true effect. The effect is larger than (numerical value) or equal to the coefficient estimate. This confirms our suspicion that the omitted variable bias will underestimate the effects.

[12] The estimations are available upon request.

[13] We refer to Altonji et al. (2005) for details on the model and the underlying assumptions.

[14] We isolate the bias from our three key-variables (dummy variables for the departure of one or more top employees in general, to spin-offs and to rivals) in turn. This does not allow us to estimate bias in the joint models (Model 8 and Model 13). We investigate the endogeneity in Model 5 to 7 and Model 10 to 12. To isolate the bias from the key-variable in question, the models exclude the clock-variable and wage score.

Moreover, this approach estimates that the bias, and hence endogeneity problem, is relatively small. The negative effect will increase (the numerical value) with less than one percentage point in all cases. For the most exposed type, departure to rival, this corresponds to an increase in the effect on parents' sales and employment of 6.9% and 14.3%, respectively.[15]

The above tests indicate that omitted variable bias only has a minor impact on our results. In the following, we introduce a final control for the implications of endogeneity. If our previous findings are subject to severe endogeneity, applying a matching approach should significantly affect the magnitude of our estimates. To assess the implications of the matching approach, we re-estimate Model 5 to 7 and Model 10 to 12.[16] However, we only include firms from the corresponding matched model (recall that the matched models are biased toward the smaller firms in the population). The matching approach did not find a significant effect on employment growth from the departure of any top employee. Nevertheless, the re-estimation of Model 5 shows a significant negative effect on employment. This indicates endogeneity in our reduced sample, as matching eliminates the effect. However, this is an isolated case. For the remaining cases, the matched models show similar or even stronger effects, supporting previous findings.

Summary and discussion

We investigate how top employees' departure for spin-off, rivals and other employment affect parent firms' survival, sales growth and employment growth. When a top employee resigns, we expect a harmful reduction in the parent firm's stock of human capital. Moreover, the event might destabilize organizational routines and trigger organizational change. For these reasons, migration of top employees is expected to affect parent firm performance negatively, independent of their reason for departure. Supporting this, we find a negative performance effect from departure in general. However, we find additional effects on parent firm performance from departure to both spin-off and rivals after controlling for general departure of top employees. These findings support the argument that transfer of human capital and social capital from the parent to a competing firm is more harmful than executive migration in general, as it increases competitive pressure on the parent

[15]This output is available upon request.
[16]The estimations are available upon request.

firm.

We hypothesize that the competitive threat, and thus the negative performance effect, could be even greater for departure to spin-off. The argument is that spin-offs, unlike incumbent firms, replicate organizational structures of their parents. This will increase similarity between spin-off and parent firm and hence competition. However, our results do not support this hypothesis. On the contrary, it is indicated that departure to rival incumbent firms might have larger negative effects on parent firm survival and sales growth than departure into spin-off entrepreneurship. However, our analysis do no show clear evidence of this. In sum, our findings support incumbent firms' apparent resistance toward general departure of top employees, especially departures to competitive firms. However, our analyses do not support an even greater resistance toward spin-offs.

We use different methods to account for endogeneity associated with both firm and top employee heterogeneity. Whether the endogeneity problem is associated with the sinking ship hypothesis or the opposite, it constitutes a potential risk, which can never be completely eliminated. However, the above tests indicate that in this study, endogeneity is associated with positive effects on firm performance, as better firms, apparently, have more spin-offs and higher migration of top-level employees. This suggests that our findings are conservative. The magnitude of the negative effects from executive migration in general, spin-offs and rivals are likely underestimated, hence emphasizing our conclusions. Moreover, we expect that stronger and healthier firms are less sensitive to e.g. loss of human capital and organizational disruptions. This suggests that these firms should be quicker to bounce back and regain strength. This scales down the overall economic implications of top employees' entry into e.g. spin-off entrepreneurship. However, we leave it for later work to investigate this.

Overall, our analysis show similar effects from departure to spin-offs and rivals. We hypothesize that an equal harmful transfer of knowledge and an equal harmful loss of social relations explain this finding. On the other hand, we find that spin-offs, conditional on mobility, are more likely to be in the upper percentile of top employees, indicating superior human capital. This suggests that the, apparently, similar effects from top employees' departure to rivals and spin-offs might rely on different explanations. For the latter it might be a significant reduction in the stock of parents' human capital, while transfer of knowledge and loss of social relations, above all, drives the negative effect for migration to rivals. However, our investigation does not provide this answer. We leave that for future

research.

We do not distinguish between single and collective migration. Following Pennings and Wezel (2007), replication of organizational routines is more likely to succeed, and thereby compose a threat to the parenting firm, when organizational members leave as a group. Furthermore, collective migration is more likely to trigger organizational change in the parent firm compared to departure of a single employee. However, we expect that controlling for this would strengthen our results.

As described above, our study shows that departure of top employees to rivals and spin-offs has negative effects on parent firm performance. But, we do not investigate how other characteristics of the receiving firm (the firm to which the top employee departs) affect the parent firm's performance. We expect that greater similarity between the parent and the receiver will increase the competitive fallout, e.g. if the two firms are established in the same environment (institutionally, geographically, socio-economically and historically) thereby increasing the likelihood that they will compete for the same resources (Sørensen, 1999; Pennings and Wezel, 2007) or because greater similarity will increase the receiving firm's absorptive capacity (Corredoira and Rosenkopf, 2010). For these reasons, later studies should undertake a more exhaustive analysis of this, investigating under which circumstances executive migration is most harmful for parent firms.

As opposed to previous studies on spin-off and executive migration, which delimit themselves by industry and geography, we have investigated the phenomenon more generally. However, the question still remains whether these findings apply equally to all industries. While factors such as social and intellectual capital have significant parts to play within some industries they are less crucial in others. We have already taken a first step, investigating consultancy industries. Future research should strive to outline in more details, which industries and under which circumstances spin-off makes a significant difference to parent firm performance. This includes investigation of spin-off by lower ranked employees and investigation of small firms (less than ten employees) as well.

We have shown a negative effect on firm performance from all types of executive migration. We partly explain this finding as loss of human capital. This negative performance effect increases with higher human capital. This might discourage firms to invest in top employees' human capital, especially if they expect high employee turnover. Moreover, we expect that idiosyncratic human capital will increase with the length of top employees tenure, indicating a larger effect on parent firm performance, when employees leave after

a longer period of employment. In many ways, the labor market in Denmark resembles the American labor market. Compared to many other European countries, the employers costs of firing employees are low. Moreover, annual rates of job creation and turnover resembles the labor market in the U.S. (Dahl and Klepper, 2008). This suggests that the effects on parent firm performance from top employee turnover might be larger in other European countries.

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Tables and figures

Figure 1: Survival curve (only including observations from Tabel 1)

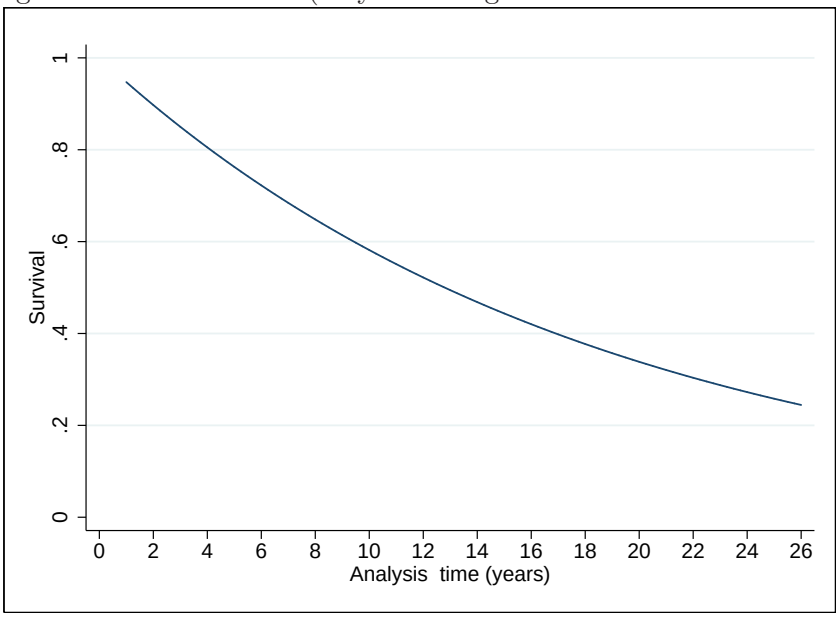

Table 1: Descriptive statistics

	None		Before		After	
Survival (1993-2006)	Mean Number	Std. Dev.	Mean Number	Std. Dev.	Mean Number	Std. Dev.
Age, years	7.66	6.47	7.45	5.70	11.86	7.00
Full-time equivalents, logged	2.47	0.43	2.43	0.58	3.25	1.00
Average gross salary blue-collar, logged	12.46	0.28	12.41	0.29	12.42	0.24
Average gross salary white-collar, logged	12.49	0.35	12.52	0.36	12.58	0.34
Average gross salary CEO, logged	12.69	0.56	12.68	0.56	12.88	0.61
Real GDP growth, percent	2.50	1.23	2.74	1.32	2.26	1.16
Wage score, conditional on departure	0		0		5.49	2.33
Wage score, conditional on departure to spin-off	0		0		6.26	2.81
Wage score, conditional on departure to rival	0		0		5.54	2.57
Time since last top employee clock	0		0		1.61	1.43
Time since last spin-off clock	0		0		0.28	1.22
Time since last top employee to rival clock	0		0		1.29	2.03
Top employee turnover, share of top employees	0		0		25.35	
Full-time employee turnover, share of ft. employees	14.10		18.16		23.77	
Companies with personal liability, percent	19.50		15.57		12.36	
No. of observations	12,385		28,951		173,146	
No. of unique firms	3,438		9,609		25,833	
No. of firm failures	2,077		0		11,482	
No. of top employees, total	43,173		92,350		2,868,700	
No. of top employees, per firm	3.49		3.19		16.57	
No. of top employee departures, total	0		0		418,403	
No. of top employee departures, per firm	0		0		2.42	
No. of top employees spin-off, total	0		0		3,995	
No. of top employees to rival, total	0		0		94,447	
Sales growth (1995-2005)						
Mean sales_t, logged	9.23^{**}			10.11^{**}		
Mean sales_{t+1}, logged	9.35^{**}			10.14^{**}		
Wage score, conditional on departure	0		0		5.44	2.35
Wage score, conditional on departure to spin-off	0		0		6.19	2.82
Wage score, conditional on departure to rival	0		0		5.49	2.60
No. of observations	7,638		21,452		117,831	
No. of unique firms	1,599		7,770		19,816	
Employment growth (1993-2007)						
Mean full-time equivalent_t, logged	2.33^{**}			3.10^{**}		
Mean full-time equivalent_{t+1}, logged	2.47^{**}			3.14^{**}		
Wage score, conditional on departure	0		0		5.46	2.34
Wage score, conditional on departure to spin-off	0		0		6.23	2.81
Wage score, conditional on departure to rival	0		0		5.52	2.59
No. of observations	12,845		43,897		171,407	
No. of unique firms	2,537		14,946		24,689	

Categories: *None* : No top employees depart within the observation period. *Before* : Observations before one or more top employees depart. *After* : Observations after one or more top employees have departed.
T-test for ln(size) (mean(none) vs. mean(before+after)).
Significance levels: † : 10% * : 5% ** : 1%

Table 2: Exponential survival model (1993-2006) – accelerated failure-time form

	(1)	(2)	(3)	(4)
Ln(full-time equivalent)$_t$	0.543**	0.514**	0.520**	0.541**
	(0.012)	(0.012)	(0.011)	(0.012)
Company with personal liability	-0.766**	-0.747**	-0.745**	-0.760**
	(0.024)	(0.024)	(0.024)	(0.024)
Ln(average gross income blue-collar)	-0.061	-0.048	-0.059	-0.068†
	(0.037)	(0.038)	(0.037)	(0.037)
Ln(average gross income white-collar)	0.078**	0.079**	0.080**	0.079**
	(0.028)	(0.029)	(0.028)	(0.028)
Ln(average gross income CEO)	0.266**	0.263**	0.263**	0.265**
	(0.016)	(0.016)	(0.016)	(0.016)
Market concentration (0-1)	1.007†	1.086†	1.056†	1.001†
	(0.606)	(0.604)	(0.602)	(0.604)
Wage score (0-10)	-0.027**	-0.061**	-0.053**	-0.027**
	(0.003)	(0.003)	(0.003)	(0.003)
Dummy: Top employee departure	-0.492**			-0.399**
	(0.035)			(0.036)
Clock: Top employee departure	0.051**			0.040**
	(0.006)			(0.006)
Dummy: spin-off		-0.090*		-0.029
		(0.040)		(0.040)
Clock: spin-off		0.012		0.006
		(0.010)		(0.010)
Dummy: rival			-0.286**	-0.206**
			(0.021)	(0.022)
Clock: rival			0.036**	0.024**
			(0.005)	(0.006)
Constant	-1.753**	-1.992**	-1.812**	-1.659**
	(0.567)	(0.573)	(0.569)	(0.566)
Size group (two dummies)	yes	yes	yes	yes
Industry (40 dummies)	yes	yes	yes	yes
Region (76 dummies)	yes	yes	yes	yes
Year	yes	yes	yes	yes
GDP Growth	yes	yes	yes	yes
Log-likelihood	-21937	-22025	-21954	-21901
Observations	214,482	214,482	214,482	214,482
Firms	29,271	29,271	29,271	29,271
Events (firm failure)	13,559	13,559	13,559	13,559

Standard errors in parentheses.
Significance levels: † : 10% * : 5% ** : 1%

Table 3: GEE panel regression of $\ln(\text{sales})_{t+1}$ (1995-2005)

	GEE				Heckman
	(5)	**(6)**	**(7)**	**(8)**	**(9)**
Ln(sales)_t	0.864**	0.858**	0.861**	0.865**	0.928**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
ln(Age)	-0.043**	-0.047**	-0.046**	-0.042**	-0.030**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)
Company with personal liability	-0.021**	-0.016**	-0.015**	-0.020**	-0.102**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.012)
Ln(average gross income blue-collar)	0.031**	0.039**	0.035**	0.028**	-0.022
	(0.008)	(0.008)	(0.008)	(0.008)	(0.014)
Ln(average gross income white-collar)	0.050**	0.051**	0.050**	0.050**	0.030**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.010)
Ln(average gross income CEO)	0.029**	0.028**	0.028**	0.029**	0.045**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.006)
Market concentration (0-1)	0.382**	0.391**	0.386**	0.381**	0.012
	(0.124)	(0.124)	(0.124)	(0.124)	(0.194)
Wage score (0-10)	-0.004**	-0.011**	-0.010**	-0.004**	-0.008**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Dummy: Top employee departure	-0.097**			-0.086**	-0.079**
	(0.004)			(0.004)	(0.012)
Clock: Top employee departure	0.005**			0.004**	0.006**
	(0.001)			(0.001)	(0.002)
Dummy: Spin-offs		-0.026**		-0.016*	-0.025
		(0.007)		(0.007)	(0.015)
Clock: Spin-off		0.004**		0.003*	0.004
		(0.002)		(0.001)	(0.003)
Dummy: Rival			-0.042**	-0.027**	-0.063**
			(0.003)	(0.003)	(0.008)
Clock: Rival			0.005**	0.003**	0.007**
			(0.001)	(0.001)	(0.002)
Constant	0.135	0.061	0.106	0.156	0.084
	(0.108)	(0.108)	(0.108)	(0.108)	(0.197)
Size group (two dummies)	yes	yes	yes	yes	yes
Industry (40 dummies)	yes	yes	yes	yes	yes
Region (76 dummies)	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes
GDP Growth	yes	yes	yes	yes	yes
IV: Sales growth rate					yes
Number of groups	22,004	22,004	22,004	22,004	
Observations	146,921	146,921	146,921	146,921	146,962
Wald Chi-Squared	722103.73	698489.30	701780.23	723200.58	523135.15

Standard errors in parentheses.
Significance levels: † : 10% * : 5% ** : 1%

Table 4: GEE panel regression of ln(full-time equivalent)$_{t+1}$ (1993-2006)

	GEE				Heckman
	(10)	**(11)**	**(12)**	**(13)**	**(14)**
Ln(full-time equivalent)$_t$	0.772**	0.762**	0.767**	0.775**	0.872**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.001)
Ln(Age)	-0.039**	-0.042**	-0.041**	-0.039**	-0.020**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Company with personal liability	-0.011**	-0.007*	-0.005†	-0.009**	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Ln(average gross income blue-collar)	-0.031**	-0.029**	-0.031**	-0.033**	-0.014**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)
Ln(average gross income white-collar)	0.018**	0.018**	0.018**	0.018**	0.008**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Ln(average gross income CEO)	0.024**	0.024**	0.023**	0.024**	0.017**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Market concentration (0-1)	0.182*	0.184*	0.179*	0.179*	0.226**
	(0.089)	(0.089)	(0.089)	(0.089)	(0.060)
Wage score (0-10)	-0.006**	-0.013**	-0.012**	-0.006**	-0.004**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dummy: Top employee departure	-0.089**			-0.074**	-0.065**
	(0.003)			(0.003)	(0.003)
Clock: Top employee departure	0.003**			0.001*	0.003**
	(0.001)			(0.001)	(0.001)
Dummy: Spin-off		-0.034**		-0.025**	-0.033**
		(0.007)		(0.007)	(0.004)
Clock: Spin-off		0.006**		0.005**	0.005**
		(0.002)		(0.002)	(0.001)
Dummy: Rival			-0.053**	-0.042**	-0.051**
			(0.003)	(0.003)	(0.002)
Clock: Rival			0.005**	0.004**	0.005**
			(0.001)	(0.001)	(0.001)
Constant	0.608**	0.587**	0.607**	0.619**	0.270**
	(0.073)	(0.073)	(0.073)	(0.072)	(0.053)
Size group (two dummies)	yes	yes	yes	yes	yes
Industry (40 dummies)	yes	yes	yes	yes	yes
Region (76 dummies)	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes
GDP Growth	yes	yes	yes	yes	yes
IV: Employment growth rate					yes
Number of groups	27,226	27,226	27,226	27,226	
Observations	228,149	228,149	228,149	228,149	212,437
Wald Chi-Squared	459452.20	420237.60	423211.43	470839.34	1437822.78

Standard errors in parentheses.
Significance levels: † : 10% * : 5% ** : 1%

Table 5: Example of data

Time	**Observation**	**Firm ID**	**Year**$_t$	**ln(sales)**$_{t+1}$	**ln(sales)**$_{t-1}$ **employee**	**Departing last departure**	**Years since**
$t-8$	1	5	1994	80		1	0
$t-7$	2	5	1995	60		1	1
$t-6$	3	5	1996	25	80	0	1
$t-5$	4	5	1997	10	60	1	2
$t-4$	5	5	1998	20	25	**0**	1
$t-3$	6	5	1999	30	10	**0**	2
$t-2$	7	5	1999	10	20	**1**	3
$t-1$	8	5	2000	25	30	**0**	1
t	**9**	**5**	**2001**	**15**	**10**	**0**	**2**
$t+1$	10	5	2002	10	25	0	3

Table 6: Categories in Table 7

0)	Treatment:	One top employee departs.
	Control:	No top employee departures within the five-year window
1)	Treatment:	One top employee departs to spin-off entrepreneurship.
	Control:	One top employee departs for other reasons (excluding departures to an incumbent firm within the same industry)
2)	Treatment:	One top employee departs to an incumbent firm within the same industry.
	Control:	One top employee departs for other reasons (excluding departures into spin-off entrepreneurship).
3)	Treatment:	One top employee departs to spin-off entrepreneurship.
	Control:	One top employee departs to an incumbent firm within the same industry.

Table 7: Matched models

	Ln(ft equivalents)$_t$	**Ln(sales)$_t$**	**Mean survival$_t$†† (5 year window)**	**Mean survival$_t$ (3 year window)**
One top employee departs vs. no top employees depart				
Estimate	0.0064	-0.0400**	-2.6322**	-0.9526**
	(0.0058)	(0.009)	(0.1229)	0.1388)
# Observations	24,334	19,644	24,334	60,157
# Treatments	4,067	3,334	4,067	13,273
# Controls	20,267	16,310	20,267	46,884
# Matches	2	2	2	2
A: Departure into spin-off entrepreneurship				
Estimate	-0.0614*	-0.1983**	-0.3637	-0.8323†
	(0.0275)	(0.0632)	(0.4956)	(0.4881)
# Observations	3,123	2,572	3,123	10,215
# Treatments	104	80	104	319
# Controls	3,019	2,492	3,019	9,896
# Matches	2	2	2	2
B: Departure into spin-off entrepreneurship				
Estimate	-0.0519†	-0.1663**	-	-0.5513
	(0.0269)	(0.0609)	-	(0.4970)
# Observations	3,123	2,572	-	10,215
# Treatments	104	80	-	319
# Controls	3,019	2,492	-	9,896
# Matches	2	2	-	2
A:Departure to a rival incumbent firm				
Estimate	-0.0256*	-0.0613**	-0.9707**	-0.9228**
	(0.0275)	(0.0195)	(0.1816)	(0.1821)
# Observations	3,963	3,254	3,963	12,954
# Treatments	944	762	944	3,058
# Controls	3,019	2,492	3,019	9,896
# Matches	2	2	2	2
B:Departure to a rival incumbent firm				
Estimate	-0.028**	-0.0626**	-	-0.573**
	(0.0098)	(0.0184)	-	(0.1767)
# Observations	3,963	3,254	-	12,954
# Treatments	944	762	-	3,058
# Controls	3,019	2,492	-	9,896
# Matches	2	2	-	2
A:Departure to spin-off entrepreneurship (vs. rival incumbent)				
Estimate	-0.018	-0.1037†	0.3566	0.2788
	(0.0287)	(0.0587)	(0.4379)	(0.4529)
# Observations	1,048	842	1,048	3,377
# Treatments	104	80	104	319
# Controls	944	762	944	3,058
# Matches	2	2	2	2
B:Departure to spin-off entrepreneurship (vs. rival incumbent)				
Estimate	-0.0284	-0.0811	-	0.1159
	(0.0282)	(0.0623)	-	(0.4638)
# Observations	1,048	842	-	3,377
# Treatments	104	80	-	319
# Controls	944	762	-	3,058
# Matches	2	2	-	2

A) Matching: Ln(size)$_{t-2}$ (or survival$_{t-2}$ estimate), Size group (three categories), Firm Age,Industry (2-digit, 41 categories) and Average gross salary$_{t-2}$ for blue collar, white collar and CEO, respectively.
B) Matching : Ln(size)$_{t-2}$, Size group (three categories), Firm Age, Wage Score (1-10), Tenure (years) and Education (years) and Employee Age
††: Single matching variable is survival$_{t-2}$ estimate
Standard errors in parentheses.
Significance levels: † : 10% * : 5% ** : 1%