The Effect of Executive Migration and Spin-offs on Incumbent Firms

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Abstract

If spin-offs are founded on intellectual capital accumulated at the parent firms, they could be potentially harmful to those firms. However, similar effects on parent firms' performance could be expected for executive migration to rivals. Exploiting a comprehensive Danish linked employer-employee database, we investigate how spin-off and executive migration to rivals affect parent firms' hazard of exit, sales growth and employment growth. We find negative performance effects from executive migration independent on where employees go to. While departures of top employees to found spin-offs have negative effects on parent firm performance, the effect is not significantly different from top employees who resign to competing incumbent firms. All effects decrease over time, but parent firms recover faster from spin-off migration. We study this using different methods, including matched models adjusting for parent firm heterogeneity.

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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, we still have relatively little knowledge on the effects of the migration of future entrepreneurs on their former employers (Klepper, 2009). So far, the conclusions on these effects are mixed. For the US hard drive industry, McKendrick et al. (2009) find that while departures of spin-off entrepreneurs at first have negative effects, organizations bounce back and regain momentum after only a few years. Some even increase their relative technological performance. On the other hand, Phillips (2002) finds that spin-offs increase the hazard of exit for Silicon Valley law firms.

While the evidence of spin-offs' showing greater performance in a broad range of industries is well established, there is almost no evidence of the effects spin-offs have on the parent firms (Phillips, 2002; Klepper, 2009), with Phillips (2002), Pennings and Wezel (2007) and McKendrick et al. (2009) as 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. This hazard increases even further the greater similarity between the business areas of spin-off and parent firm. Similarly, in a study of the Dutch accounting sector, Pennings and Wezel (2007) find that parent firms' hazard of exit increases when top employees resign to work at a newly founded firm. Finally, McKendrick et al. (2009) study how the technological performance of the parent firm is affected by spin-off. They find an initially negative effect on 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

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

negative effect is only temporary and that parent firms are likely to perform better after the spin-offs have departed.

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. 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 (Dahl and Gjerløv-Juel, 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

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, 2007; 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 thread, 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 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.

We argue that the 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 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.

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, loosing 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 entrepreneurship (intentional discharge being the exception).

Hypothesis 1: Top employees departing for spin-off are not more harmful to parent firms than top employees departing to other occupations.

While this hypothesis centers on the argument that departing top employees equally reduce the parent firm's stock of human capital and trigger organizational change, only departures for spin-off will increase competitive pressure. This could make spin-offs departures even more harmful than other types of top employee migration. This competitive thread 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, 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. 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. For these reasons, we attest:

Hypothesis 2: Top employees departing for spin-off are not more harmful to parent firms than top employees departing to rival incumbent firms.

These arguments also imply that departures to spin-offs or rivals are worse for the parent firm than departures to entrepreneurship in remote industries or to non-rival incumbents. In the latter cases, social relations from the parent firm could play a much smaller role. Thus, we hypothesize:

Hypothesis 3: Departure of top employees to spin-off entrepreneurship or rival incumbents has a greater negative effect on parent firms' performance than migration to other desti-

nations.

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, 2007; 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 is more harmful in the case of spin-off.

Hypothesis 4: The departure of top employees to spin-off entrepreneurship will cause a greater negative effect on parent firms' performance than departure to rival incumbent firms.

Finally, 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 implies 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.

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. Legal individual owner(s) and founder(s) are top employees regardless of their salary.

Parent firms are firms that loose 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.[2]

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 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

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

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 have had their first spinoff. 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 want to measure 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.[3] 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

[3]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.

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.[4] To 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)).[5]

In addition to the covariates described above, we include controls for firm age (logged),

[4]We estimated a negative binomial model (see Table 10). The dependent variable was the wage score as described below. We include4,671,045 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 relative 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.

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

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))[6], year dummies, GDP growth (yearly growth rate, percent) and, finally, labor market region dummies (77 categories).

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). Descriptive statistics for the variables used in the survival analysis are presented in Table 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:

$$\frac{S_{i,t+1}}{S_{i,t}} = S_{i,t}^{\alpha-1} e^{\beta_1 x_{1i,t} + ... + \beta_k x_{ki,t} + \epsilon_{i,t+1}}, \tag{1}$$

which can be rearranged into the log-linear model:

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

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

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

given in Equation 2. Data limitations restrict the observation period to 1995-2005, when estimating $ln(sales)_{t+1}$. The descriptives for the GEE models are presented in Table 2 and Table 3, respectively. Except from the size and age variables, both models of firm growth include the same set of covariates as the firm failure models.

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 $ln(full\text{-}time\ equivalent)_{t+1}$. Estimating $ln(sales)_{t+1}$, we include *ln(full-time equivalent)* as our instrument variable.

Results

Firm survival

Table 4 presents results from exponential survival models estimating the effect from spin-offs and executive migration on the hazard of exit. 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. Loosing 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 loose 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 spin-offs is also found for cases, where the top employee leaves for incumbent rivals. This is shown in Model 3. If a firm looses 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 reduces the time to failure by additionally 18.6% compared to executive migration in general.

Firm growth

Table 5 presents results from GEE panel regression estimating the effect from spin-off and 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-offs and founds a new firm in the same industry also have a significant and negative effect on sales of parent firm (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. These results support Hypothesis 3. Departure for spin-offs and rivals reduces sales by additionally 1.6% and 2.7%, respectively. The effects do not differ significantly. Aggregating the effects from migration in general, wage score (average is 6.19) and spin-off, 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%. The effect diminishes by 0.3% per year for both spin-offs and rivals.

Controlling for selection bias, we estimate $ln(sales)_{t+1}$ using the Heckman selection model (see Model 9). However, the selection equation is not significant, indicating no selection bias.

We test these findings against another dependent variable, employment growth in the year after the departure of one or more top employees. Table 6 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 is now significant, but not to a degree that alters the previous conclusion. Executive migration has a negative effect on parent firm performance. This negative effect increases when top employees depart for spin-off or incumbent rivals, supporting Hypothesis 3. Again, effects are reduced over time.

Effects over time

We illustrate the effect on the parent firm's growth rate following (McKendrick et al., 2009):

Effect on growth rate = $\exp(\ \beta_1 * Top\ employee\ dummy + \beta_2 * Time\ since\ last\ top\ employee$

$clock + \beta_3 * Top\ employee\ to\ spin\text{-}off\ dummy + \beta_4 * Time\ since\ last\ top\ employee\ to\ spin\text{-}off\ clock + \beta_5 * Top\ employee\ to\ rival\ dummy + \beta_6 * Time\ since\ last\ top\ employee\ to\ rival\ clock + \beta_7 * Wage\ score$),

where β_3 and β_4 take the value zero if no top employees have departed for spin-off. Similarly, β_5 and β_6 take the value zero if no top employees have resigned to an incumbent rival. This equation is the multiplier of the growth rate. It is illustrated for parent firms' sales and employment growth (see in Figure 2 and Figure 3, respectively). We use the average wage score from the three types of departures (see Table 2 and Table 3). The effects on parent firm growth rates are only shown for the first 13 years after the departure of top employees, as this is the maximum value for the clock variable in our dataset.

Figure 2 shows a multiplier of 0.90 in the year following the departure of any top employee. This indicates, that as a result of losing a top employee, parent firms' have ten pct. lower sales than equivalent firms not experiencing such departure. For departure to spin-off or to a rival firm, the multipliers are instead 0.89 and 0.88, respectively. This means that parent firms are initially worse of if top employees depart for spin-off or rivals. However, this holds until the seventh year. Then, the overall negative performance effect from spin-off is reduced below executive migration in general. For top employees resigning to work for incumbent rivals, the overall negative performance effect remains above the negative effect from general executive migration until the tenth year.

In the last year of the investigation period (after 13 years), Figure 2 shows a multiplier of 0.96 for top employees departing for spin-off or rival and 0.95 for departures in general. I.e. for every category, the overall effect on parent firms' sales growth remains negative for the first 13 years.

Figure 3 illustrates the overall effect on parent firms' employment growth. It shows a similar pattern of recovery for the three categories (general, spin-off and rival), supporting the above findings.

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 loosing 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 have been labelled *the sinking ship hypothesis*.

For spin-offs in particular, the 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. This means that we should find more spin-offs in the firms that have had the highest growth rates in the past years. We test this hypothesis in our sample for top employees in general, top employees departing for rivals and top employees departing as spin-offs.

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). These three models are presented in Table 11. All models include dummy variables for size, industry, region and year.

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*. Further, it indicates that endogeneity is associated with positive effects on firm performance, e.g. if better firms have more spin-offs or higher migration of top-level employees. We expect that stronger and healthier firms are less sensitive to e.g. loss of human capital and organizational disruptions. This suggests that our previous findings are conservative. The magnitude of the negative effects from executive migration in general, spin-offs and rivals are likely underestimated. We test this 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.[7] 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.[8] 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. Moreover, this approach estimates that the bias, and hence endogeneity problem, is relative 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.[9]

However, 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. Nevertheless, we can reduce this risk to an absolute minimum supplementing the above with a matching approach. This ensures that firms are completely comparable in the point of origin – the time of top employees' departure; in general, to rivals and as spin-offs. Table 7 illustrates this. Firstly, we match firms on their ex ante performance, i.e. employment (logged), sales (logged) or survival (estimated). Moreover, 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 7).

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 7). The firms satisfying these criteria are matched with a sample of firms that experience no top employee departures

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

[8] 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.

[9] We do not report the estimations underlying these results. This output is available upon request.

within a five-year window. We refer to the latter as "controls". In every case, we match 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.[10]

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 4. 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).

Table 8 describes the categorization into different groups of treated and controls. 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 employ departing for spin-off with other single top employee departures (excluding departures to rivals). 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.

Finally, investigating Hypothesis 3 in more detail, we match departures from the consultancy industries with the no-departure-firms and with general migration, respectively. Moreover, we match departures for spin-off and rivals with other departures, excluding all but the consultancy industries. Limited by the level of detail in the data, we only label industries "consultancy", when 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. How-

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

ever, we exclude these, questioning the degree to which costumers preferences relates 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.

First, we estimate the effect of one top employee that departs independent of the post-departure occupation. We no longer find a significant effect on employment growth from migration in general (see Tabel 9). 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 sales. On average, loosing 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 9 further indicates a negative effect on survival. However, this effect is barely significant.

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 estimate a stronger negative effect on survival from departure to rivals.

The above findings suggest a stronger 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.

Finally, we investigate departures from the consultancy industry. Within the consultancy industry, the effect on survival is, apparently, larger than the general effect of migration. On the other hand, we find no effects on employment and sales within the industry. 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 in general, strongly supporting our hypothesis. The above arguments suggest that top employees' departure to rival incumbent firms and spin-offs are relatively more harmful within in the consultancy industry. The final models test this. 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.

Overall, the matched models support our previous findings. However, it is important to emphasize that this analysis is not directly comparable with the former. 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.

The above tests indicated that omitted variable bias has a minor impact on our results. In the following, we introduce an additional 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. However, we only include firms from the corresponding matched model. Results are shown in Table 12. 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 negative effect on employment of 5.2% two years after departure.[11] 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 resign, 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

[11] The average wage score for this population is 5.54.

than executive migration in general, as it increases competitive pressure on the parent firm.

We hypothesize that the competitive thread, and thus the negative performance effect, is even greater for departure to spin-off. The argument is that spin-offs, unlike incumbent firms, replicate organizational structures of their parents, as no preexisting organizational culture or routines refrain them from doing so. This will increase similarity between spin-off and parent firm and hence competition. However, our analysis do not 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.

As stated above, our models show similar effects from departure to spin-offs and rivals, supporting Hypothesis 2. 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. Moreover, we do not investigate the effect of individual characteristics, e.g. education and tenure. We aim to asses the general consequences of executive migration and spin-off before engaging in a more detailed level of analysis. However, we expect that the negative effects from departure in general, to spin-off and to rivals will enhance if we include more controls, hence emphasizing our conclusions.

Similarly, 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 thread 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. Again, we expect that controlling for this would strengthen our results.

Finally, we show that these negative performance effects diminish over time. We have argued that this is the result of organizational restructuring. For departure to spin-

off, however, we show that parents make a faster recovery. This indicates that more factors than organizational adaption are at play. Alternative explanations might rely on agglomeration, selection and/or legitimation effects. These indicate that parent firm performance are subject to two opposite effects from departure to spin-off; a relative stronger negative effect on the individual firm, which is partly offset by a positive effect to the industry. Furthermore, our analysis indicates that parents recover faster from departure to spin-off. Apparently, stronger firms spawn more spin-offs (see Table 11). These are more quickly to bounce back and regain strength. This scales down the overall economic implications of top employees' entry into entrepreneurship. However, we leave it for later work to investigate this.

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-economical 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 a significant part 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.

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Tables and figures

Table 1: Descriptive statistics for firm failure (1993-2006)

	None		Before		After	
Variable	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
	Mean Number		Mean Number		Mean Number	
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	

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.
Significance levels: † : 10% * : 5% ** : 1%

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

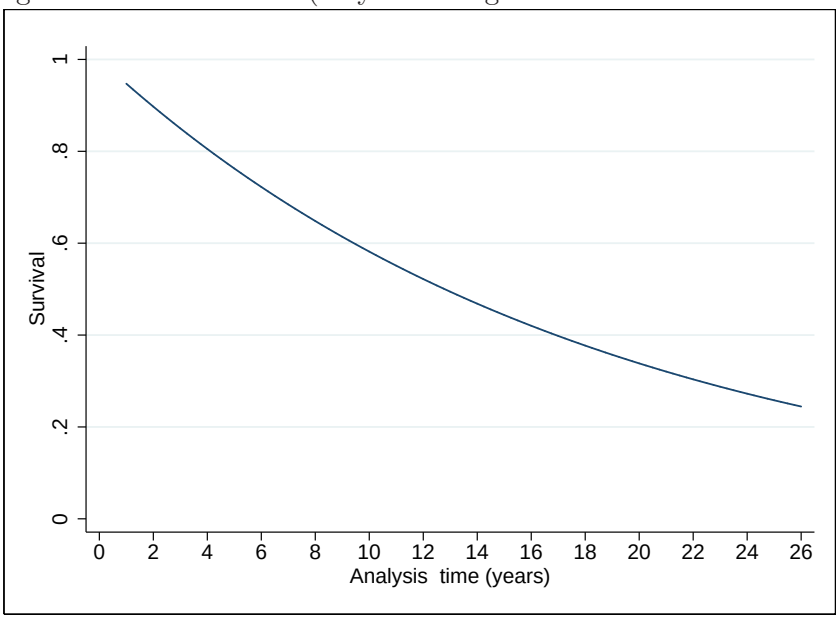

Figure 2: Effect on sales growth rate (parameter estimates from Table 5, Model 8)

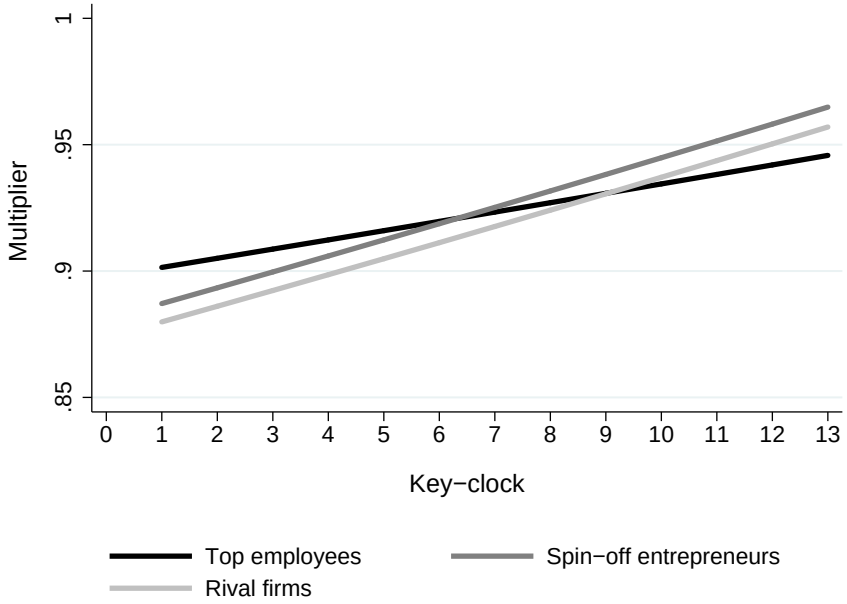

Table 2: Descriptive statistics for GEE panel regressions of $\ln(\text{sales})_{t+1}$ (1995-2005)

	None		**Before**		**After**	
Variable	Mean Number	Std. Dev.	Mean Number	Std. Dev.	Mean Number	Std. Dev.
Age, years	7.02	6.81	5.70	6.06	11.98	7.14
Average gross salary blue-collar, logged	12.44	0.25	12.42	0.28	12.42	0.22
Average gross salary white-collar, logged	12.48	0.35	12.50	0.37	12.57	0.34
Average gross salary CEO, logged	12.65	0.52	12.62	1.00	12.87	0.58
Real GDP growth, percent	1.90	1.00	2.07	1.00	1.90	1.01
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
Time since last top employee clock	0		0		1.68	1.48
Time since last spin-off clock	0		0		0.29	1.23
Time since last top employee to rival clock	0		0		1.34	2.06
	Mean Number		Mean Number		Mean Number	
Top employee turnover, share of top employees	0		0		24.57	
Full-time employee turnover, share of ft. employees	16.97		19.20		24.90	
Companies with personal liability, percent	16.13		13.81		10.86	
No. of observations	7,638		21,452		117,831	
No. of unique firms	1,599		7,770		19,816	
No. of top employees, total	21,438		64,469		1,820,616	
No. of top employees, per firm	2.81		3.01		15.45	
No. of top employee departures, total	0		0		273,807	
No. of top employee departures, per firm	0		0		2.76	
No. of top employees spin-off, total	0		0		2,723	
No. of top employees to rival, total	0		0		57,169	
Mean sales_t, logged	9.23^{**}			10.11^{**}		
Mean sales_{t+1}, logged	9.35^{**}			10.14^{**}		

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(sales) (mean(none) vs. mean(before+after)). Significance levels: † : 10% * : 5% ** : 1%

Table 3: Descriptive statistics for GEE panel regressions of ln(full-time equivalents)$_{t+1}$ (1993-2007)

	None		**Before**		**After**	
Variable	Mean Number	Std. Dev.	Mean Number	Std. Dev.	Mean Number	Std. Dev.
Age, years	6.82	6.51	6.33	5.75	11.55	7.09
Average gross salary blue-collar, logged	12.42	0.29	12.39	0.30	12.41	0.24
Average gross salary white-collar, logged	12.49	0.35	12.52	0.36	12.58	0.33
Average gross salary CEO, logged	12.65	0.54	12.66	0.57	12.88	0.61
Real GDP growth, percent	2.18	1.41	2.00	1.79	2.16	1.27
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
Time since last top employee clock	0		0		1.52	1.45
Time since last spin-off clock	0		0		0.26	1.19
Time since last top employee to rival clock	0		0		1.22	2.00
	Mean Number		Mean Number		Mean Number	
Top employee turnover, share of top employees	0		0		24.82	
Full-time employee turnover, share of ft. employees	17.30		19.05		25.71	
Companies with personal liability, percent	17.73		15.67		11.70	
No. of observations	12,845		43,897		171,407	
No. of unique firms	2,537		14,946		24,689	
No. of top employees, total	21,438		64,469		1,820,616	
No. of top employees, per firm	2.84		3.14		17.38	
No. of top employee departures, total	0		0		273,807	
No. of top employee departures, per firm	0		0		2.76	
No. of top employees to spin-off, total	0		0		2,723	
No. of top employees to rival, total	0		0		57,169	
Mean full-time equivalent$_t$, logged	2.33**		3.10**			
Mean full-time equivalent$_{t+1}$, logged	2.47**		3.14**			

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(full time equivalents) (mean(none) vs. mean(before+after)).
Significance levels: † : 10% * : 5% ** : 1%

Table 4: 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 5: GEE panel regression of ln(sales)$_{t+1}$ (1995-2005)

	GEE				Heckman
	(5)	**(6)**	**(7)**	**(8)**	**(9)**
Ln(sales)$_t$	0.864**	0.858**	0.861**	0.865**	0.837**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)
ln(Age)	-0.043**	-0.047**	-0.046**	-0.042**	-0.043**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Company with personal liability	-0.021**	-0.016**	-0.015**	-0.020**	-0.025**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Ln(average gross income blue-collar)	0.031**	0.039**	0.035**	0.028**	0.036**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.005)
Ln(average gross income white-collar)	0.050**	0.051**	0.050**	0.050**	0.056**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Ln(average gross income CEO)	0.029**	0.028**	0.028**	0.029**	0.035**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Market concentration (0-1)	0.382**	0.391**	0.386**	0.381**	0.360**
	(0.124)	(0.124)	(0.124)	(0.124)	(0.059)
Wage score (0-10)	-0.004**	-0.011**	-0.010**	-0.004**	-0.004**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Dummy: Top employee departure	-0.097**			-0.086**	-0.089**
	(0.004)			(0.004)	(0.005)
Clock: Top employee departure	0.005**			0.004**	0.003**
	(0.001)			(0.001)	(0.001)
Dummy: Spin-off		-0.026**		-0.016*	-0.016**
		(0.007)		(0.007)	(0.006)
Clock: Spin-off		0.004**		0.003*	0.004*
		(0.002)		(0.001)	(0.001)
Dummy: Rival			-0.042**	-0.027**	-0.027**
			(0.003)	(0.003)	(0.003)
Clock: Rival			0.005**	0.003**	0.003**
			(0.001)	(0.001)	(0.001)
Constant	0.135	0.061	0.106	0.156	0.185*
	(0.108)	(0.108)	(0.108)	(0.108)	(0.077)
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
Number of groups	22,004	22,004	22,004	22,004	
Observations	146,921	146,921	146,921	146,921	177,760
Wald Chi-Squared	722103.73	698489.30	701780.23	723200.58	1168715.15

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

Table 6: 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
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%

Figure 3: Effect on employment growth rate (parameter estimates from Table 6, Model 13)

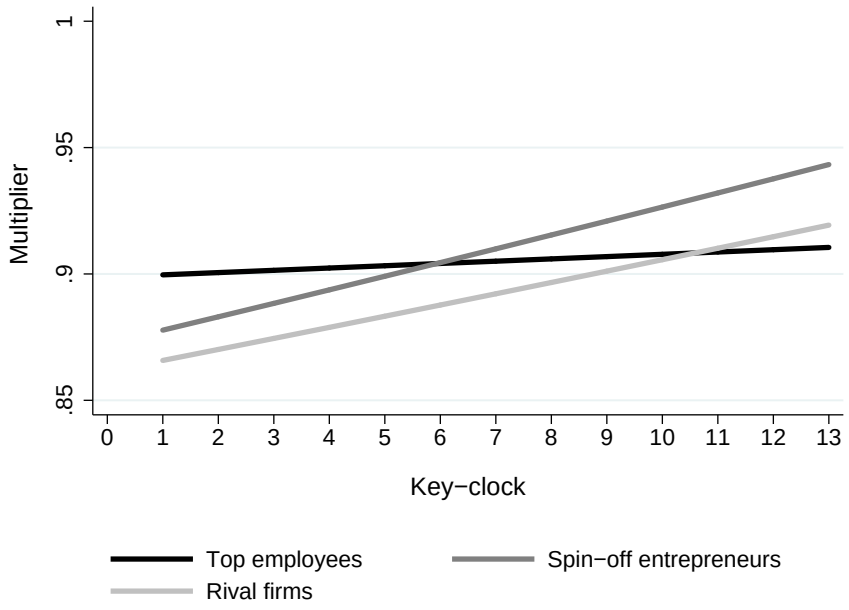

Table 7: Example of data

Time	**Observation**	**Firm ID**	**Year**$_t$	**ln(sales)**$_t$	**ln(sales)**$_{t-2}$ **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 8: Categories in Table 9

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.
4)	Treatment:	One top employee departs from the consultancy industry.
	Control:	One top employee from departs from another industry.
5)	Treatment:	One top employee departs from the consultancy industry.
	Control:	No top employee departures within the five-year window.
6)	Treatment:	One top employee from the consultancy industry departs to spin-off entrepreneurship or to an incumbent firm within the same industry.
	Control:	One top employee from the consultancy industry departs for other reasons.

Table 9: Matched models

	Ln(ft equivalents)$_t$	**Ln(sales)$_t$**	**Mean survival time$_t$ (5 year window)**	**Mean survival time$_t$ (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
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
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
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
Departure from consultancy (vs. other industries)				
Estimate	-0.0410	-0.3857**	-0.5891†	-0.5535
	(0.0294)	(0.0723)	(0.3537)	(0.4939)
# Observations	4,067	3,334	4,067	13,273
# Treatments	222	143	222	675
# Controls	3,845	3,191	3,845	12,598
# Matches	2	2	2	2
One top employee departs vs. no top employees depart (consultancy only)				
Estimate	0.0211	-0.0485	-3.9714**	-3.3093**
	(0.02667)	(0.0479)	(0.6220)	(0.6051)
# Observations	1,505	874	1,505	3,478
# Treatments	1,283	143	1,283	2,803
# Controls	222	731	222	675
# Matches	2	2	2	2
Departure to spin-off or rival vs other (consultancy only)				
Estimate	-0.0156	-0.0018	-1.6102*	-1.9103**
	(0.0355)	(0.0757)	(0.6411)	(0.5873)
# Observations	222	143	222	169
# Treatments	85	51	85	64
# Controls	137	92	137	105
# Matches	2	2	2	2

Matching variables: Size group (three categories), ln(size)$_{t-2}$, Age, Industry (2-digit, 41 categories) and Average gross salary$_{t-2}$ for blue collar, white collar and CEO, respectively.
Standard errors in parentheses.
Significance levels: † : 10% * : 5% ** : 1%

Table 10: Negative binomial model - ranking top employees by wage score 0-10, 10 is highest (1993-2006)

	(1)	(2)	(3)	(4)
Top employee departure	-0.002**			
	(0.001)			
Age	0.023**	0.034**	0.034**	0.034**
	(0.000)	(0.001)	(0.001)	(0.001)
Age^2	-0.000**	-0.000**	-0.000**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Tenure	-0.000**	-0.000**	-0.000**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Tenure^2	0.000**	0.000**	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Work experience	0.077**	0.035**	0.036**	0.036**
	(0.000)	(0.001)	(0.001)	(0.001)
Male	0.215**	0.197**	0.195**	0.195**
	(0.001)	(0.002)	(0.002)	(0.002)
Children	0.033**	0.043**	0.042**	0.042**
	(0.001)	(0.002)	(0.002)	(0.002)
Education	0.043**	0.040**	0.040**	0.040**
	(0.000)	(0.000)	(0.000)	(0.000)
Dispersion in wage structure	-0.026**	-0.032**	-0.033**	-0.033**
	(0.000)	(0.001)	(0.001)	(0.001)
ln(ft equivalents)	0.007**	0.005**	0.005**	0.005**
	(0.000)	(0.001)	(0.001)	(0.001)
ln(top employees)	-0.034**	-0.022**	-0.021**	-0.021**
	(0.000)	(0.001)	(0.001)	(0.001)
Company with personal liabilities	0.029**	0.088**	0.088**	0.088**
	(0.001)	(0.003)	(0.003)	(0.003)
Dummy: Spin-off		0.123**		0.030**
		(0.007)		(0.008)
Dummy: Rival		0.019**	0.025**	0.025**
		(0.002)	(0.002)	(0.002)
Dummy: Entrepreneurship			0.106**	0.100**
			(0.003)	(0.003)
Constant	0.074**	0.310**	0.309**	0.309**
	(0.007)	(0.017)	(0.017)	(0.017)
Industry (40 dummies)	yes	yes	yes	yes
Region (76 dummies)	yes	yes	yes	yes
Year	yes	yes	yes	yes
lnalpha				
Constant	-2.134**	-1.967**	-1.971**	-1.971**
	(0.002)	(0.005)	(0.005)	(0.005)
Pseudo R^2	0.02	0.02	0.02	0.02
Log-likelihood	-11473382	-1494864	-1494509	-1494503
Observations	4,671,045	606,812	606,812	606,812

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

Table 11: Negative binomial model: Number of top employees departing (1993-2006)

	(All)	**(Rival)**	**(Spin-off)**
Employment growth$_t$	0.001**	0.001**	0.003**
	(0.000)	(0.000)	(0.001)
Employment growth$_{t-1}$	0.001**	0.001*	0.002*
	(0.000)	(0.000)	(0.001)
Employment growth$_{t-2}$	0.001**	0.001**	0.001†
	(0.000)	(0.000)	(0.001)
Ln(full-time equivalent)$_t$	1.069**	0.996**	0.721**
	(0.008)	(0.017)	(0.029)
Company with personal liability	0.081**	0.121**	0.292**
	(0.016)	(0.026)	(0.061)
Ln(average gross income blue-collar)	-0.239**	-0.402**	-0.341**
	(0.022)	(0.043)	(0.086)
ln(average gross income white-collar)	0.057**	-0.008	0.053
	(0.014)	(0.029)	(0.075)
Ln(average gross income ceo)	-0.002	-0.024	0.041
	(0.008)	(0.016)	(0.035)
Market concentration (0-1)	0.254	0.311	-1.228
	(0.395)	(0.678)	(2.865)
GDP Growth	0.062**	0.093**	0.048
	(0.006)	(0.013)	(0.032)
Constant	-1.212**	0.272	-4.152**
	(0.316)	(0.611)	(1.339)
Size group (two dummies)	yes	yes	yes
Industry (40 dummies)	yes	yes	yes
Region (76 dummies)	yes	yes	yes
Year	yes	yes	yes
lnalpha			
Constant	-0.489**	0.947**	1.122**
	(0.016)	(0.020)	(0.088)
Pseudo R^2	0.17	0.12	0.13
Log-likelihood	-202775	-91766	-12779
Observations	156,944	158,290	159,019

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

Table 12: GEE panel regression of ln(ft equivalents)$_{t+1}$ (1993-2006) and ln(sales)$_{t+1}$ (1995-2005) on sample from matching models

	(5b)	**(6b)**	**(7b)**	**(10b)**	**(11b)**	**(12b)**
ln (sales)	0.871**	0.883**	0.881**			
	(0.005)	(0.008)	(0.008)			
ln(ft equivalents)				0.779**	0.763**	0.768**
				(0.006)	(0.011)	(0.010)
ln (age)	-0.040**	-0.038**	-0.034**	-0.033**	-0.029**	-0.028**
	(0.002)	(0.004)	(0.004)	(0.002)	(0.003)	(0.002)
Company with personal liability	-0.019**	-0.015*	-0.007	-0.013**	-0.016**	-0.010†
	(0.005)	(0.008)	(0.007)	(0.004)	(0.006)	(0.006)
ln(average gross income blue-collar)	0.051**	0.044**	0.050**	-0.014*	-0.004	-0.008
	(0.010)	(0.015)	(0.014)	(0.006)	(0.008)	(0.007)
ln(average gross income white-collar)	0.036**	0.034**	0.041**	0.014**	0.012*	0.015**
	(0.005)	(0.008)	(0.008)	(0.004)	(0.005)	(0.005)
ln(average gross income ceo)	0.029**	0.020**	0.019**	0.023**	0.021**	0.018**
	(0.004)	(0.005)	(0.005)	(0.002)	(0.003)	(0.003)
Wage score	-0.002**	-0.004**	-0.004**	-0.004**	-0.005**	-0.005**
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Dummy: Top employee departure	-0.047**			-0.030**		
	(0.005)			(0.004)		
Clock: Top employee departure	0.003**			-0.000		
	(0.001)			(0.001)		
Dummy: Spin-off		-0.040*			-0.030*	
		(0.016)			(0.012)	
Clock: Spin-off		0.008**			0.005†	
		(0.003)			(0.003)	
Dummy: Rival			-0.034**			-0.041**
			(0.006)			(0.005)
Clock: Rival			0.003*			0.004**
			(0.001)			(0.001)
Constant	-0.069	0.037	-0.121	0.347**	0.313**	0.330**
	(0.141)	(0.212)	(0.202)	(0.082)	(0.119)	(0.109)
Size group (two dummies)	yes	yes	yes	yes	yes	yes
Industry (40 dummies)	yes	yes	yes	yes	yes	yes
Region (76 dummies)	yes	yes	yes	yes	yes	yes
Year	yes	yes	yes	yes	yes	yes
GDP Growth	yes	yes	yes	yes	yes	yes
Firms	7,084	2,336	2,887	8,240	2,800	3,456
chi2	366180.16	25717.03	72466.21	1075781.52	75466.32	558096.48
Observations	57,856	20,413	24,991	92,174	33,259	40,756

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