Mobilizing Social Capital Through Employee Spinoffs: Evidence from Brazil*

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Abstract

One social benefit of organizing employees into firms is the creation of teams that found new firms. We model this process by extending the Jovanovic (1979) theory of job matching and employee turnover to allow employees to learn about their colleagues' qualities faster than their employer and recruit them to join "spinoff" firms. Our model predicts that the hazard rate of separation from the new firm of these former colleagues from the "parent" firm will be lower than for workers hired from outside at founding, and that this difference will shrink with worker tenure at the new firm. These predictions are strongly supported in Brazilian data for the period 1995-2001. Cumulatively, after five years workers hired from the parent firm are 52 percent more likely to remain with the spinoff firm than outside hires.

Keywords: Employee spinoffs; entrepreneurship; firm performance; labor turnover

JEL Classification: L26, L25, J21

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1 Introduction

Like cities, firms bring people together, in ways both planned and unplanned. By greatly increasing the frequency of their interactions, a firm causes its employees to learn more about each other's capabilities and preferences. This information can prove useful to one or more employees with an idea that can be best exploited by forming a new firm. These worker-entrepreneurs can try to lure away those of their co-workers whom they believe will be most productive in the new enterprise. We will refer to the employee entrepreneurs and those of their colleagues whom they succeed in hiring as the "founding team" of an employee spinoff from a parent firm.[1]

Our model implies that the amount of "social capital" developed among employees within a firm is much greater than what is needed to sustain joint leisure-time activities. The employees who join the spinoff firm are sufficiently confident in the entrepreneurs' idea and their match with it to leave their jobs and found a new formal sector enterprise. At the same time, we take a conservative approach to the value generated by this social capital compared to the literature that connects teams to firm performance (e.g. Phillips 2002). In our model that value is given by the number of employees who leave the parent for the spinoff multiplied by the difference between the value of a wage contract where match quality is known to be high and a wage contract where the match quality is uncertain.[2] We do not rule out a connection between team size and composition and firm performance as measured, for instance, by firm survival. At this stage, we simply note that it is difficult to identify such a connection when one can argue that entrepreneurs with a better idea can attract a better founding team.

Our initial empirical work is concerned with identifying the learning about match quality that occurred within the parent firm by contrasting outcomes in the spinoff for employees hired from the parent with outcomes for those hired from outside. In later drafts, we will test the predictions of our model regarding which employees in the parent firm join the employee spinoff.

One of our important tasks will be to distinguish employee spinoffs from planned divestitures and thus employee-initiated founding teams from those formed by employers. For this purpose we will build on the work of Hirakawa, Muendler and Rauch (2010, hereafter HMR) and use information about both the share of a parent plant's workers hired by the new firm and about the legal form of the new firm, in particular whether it can be owned by the parent firm.

[1] Holmstrom (1982, p. 325) defines a "team" as "a group of individuals who are organized so that their productive inputs are related." In our model all members of the founding team have high match quality with the entrepreneurs' idea but otherwise their productive inputs are not related. Unlike the vast literature building upon Holmstrom's article, our main interests are in the process of founding team formation rather than in the incentive structures used to elicit output from a given team.

[2] A worker who knows his match quality with the parent is high will not join the spinoff.

2 Model

2.1 Basics

Our model builds upon the influential Jovanovic (1979) theory of job matching and employee turnover. Jovanovic models the evolution of one match between an employer and an employee. When the employee is hired the parties are uncertain about the quality of the match between them. A process of Bayesian updating ensues, in which (roughly speaking) many good productivity realizations cause expected productivity to increase and the wage to increase, and many bad realizations cause the wage to fall, leading to separation. The key results are that, on average, wages rise with employee tenure and the hazard rate of separation falls because surviving matches have been selected for high quality.

Our first extension of Jovanovic (1979) is to allow for multi-employee firms: instead of one worker, each firm employs a unit measure of workers. We assume that there are constant returns to scale in production and that labor is the only input to production. It follows that the output of any employee in a firm is additively separable from that of every other employee. Nevertheless, it is important to know for which firm employees are working because we assume that any employee can only learn about the characteristics of other employees in his own firm.

Our second extension of Jovanovic (1979) is to allow for the possibility of employee entrepreneurship. A small fraction of employees in a firm may get an idea for a new firm, forming an entrepreneurial partnership. We assume that these employees can best exploit their idea outside the boundary of the existing *parent* firm because of contracting or incentive problems within the firm (Anton and Yao 1995) or because their new business plan is a poor fit for their employer (Henderson and Clark 1990, Tushman and Anderson 1986). We also assume that when their idea arrives the *spinoff* entrepreneurs learn about the match quality of their colleagues with their planned firm through their interaction with them in the workplace.

For those colleagues with whom they work closely, the potential entrepreneurs learn match quality with their planned spinoff firm faster than their current employer learns the same employees' match quality with the existing parent firm. Since we do not observe the arrival of the entrepreneurs' idea, we simply assume that all of their learning takes place at the moment when the idea arrives. An advantage of this formulation is that it allows for the possibility that, when their idea arrives, the state of the entrepreneurs' knowledge of their colleagues is such that they already recognize who will be a good match for their planned firm. A spinoff firm thus has the potential to hire employees known to be of high match quality, a possibility that does not arise in Jovanovic (1979).

2.2 Employer learning

Moscarini (2005) simplifies Jovanovic (1979) by allowing match quality to take on only two values, high and low, and we adopt his simplification and much of his notation here. A

high-quality match produces a flow of output μ_H in continuous time and a low-quality match generates output $\mu_L < \mu_H$, where μ_H and μ_L are identical across firms. Output is also homogeneous across firms so every job produces either μ_H or μ_L, irrespective of firm age and other employer characteristics. Employers and employees are risk-neutral optimizers who discount future payoffs at rate r.

Employers continuously observe the flow of output from their firms, but information about the output of any individual employee only arrives at Poisson rate ϕ. This information reveals whether the quality of the match between the employee and the firm is high or low. We add to this Poisson process another that is already present in Moscarini (2005), in which employer and employee exogenously separate at rate δ, for example because a spouse was relocated.

Workers are matched randomly to vacancies. Denote by p_0 the probability that an employee matched randomly to a vacancy will be a high quality match for the firm that hires him. Denote by $q_i(t)$ the proportion of employees in firm i of unknown match quality at time t. If we provisionally assume that employees discovered to be low quality matches separate from the firm (see below), then since there is a unit measure of employees output $x_i(t)$ of firm i at time t is given by

$$x_i(t) = q_i(t)[p_0\mu_H + (1-p_0)\mu_L] + (1-q_i(t))\mu_H. \tag{1}$$

We follow Jovanovic and consider wage outcomes where every employee receives his expected marginal product. We can then compactly express any employee's wage as

$$w(p) = p\mu_H + (1-p)\mu_L, \text{ where } \begin{cases} p = p_0 & \text{before match quality is revealed} \\ p = 1 & \text{as soon as match quality is revealed} \end{cases}. \tag{2}$$

Because workers are matched randomly to vacancies, $p = p_0$ at the time of hiring. As soon as the firm learns about an employee's match quality, p is reset to 1 and the employee is promoted with a pay raise from $w(p_0)$ to $w(1) = \mu_H > w(p_0)$. If an employee is revealed to be low quality, the employee would be "demoted" to $w(0) = \mu_L$ and therefore chooses to quit because an existing outside employer will pay $w(p_0) > \mu_L$ at hiring. There is no forgetting, so an employee's wage at a given firm i weakly rises over time.

Now consider a tenure cohort within a firm, that is, a strictly positive measure of employees with identical tenure. As time progresses, learning strictly changes the tenure cohort's average wage and its average hazard rate of separation. For any individual worker, the wage only weakly increases with tenure and both the endogenous hazard of quitting $\phi(1-p_0)$ and the exogenous hazard of dissolution δ are constant. But for a cohort of workers who are still employed at the same firm, the fraction of workers with known match quality strictly increases with tenure, hence a cohort's average wage strictly increases with tenure. Similarly, for a cohort of workers who are still employed at the same firm, the average hazard rate of separation strictly drops over time because the rate of endogenous quitting drops as the fraction of workers with known match quality in the cohort strictly increases over time. We summarize these findings in a Lemma.

Lemma 1. *For any cohort of employees with tenure τ at a firm i, the average wage strictly increases with tenure and the average hazard rate of separation strictly decreases.*

Proof. Denote by $q_i(\tau)$ the fraction of the cohort of employees with tenure τ at a firm i with unknown match quality. The average wage of this cohort is then given by $q_i(\tau)w(p_0) + [1-q_i(\tau)]w(1)$, where $w(p)$ is given by equation (2). The average hazard rate of separation of this cohort is given by $q_i(\tau)[\delta + \phi(1-p_0)] + [1-q_i(\tau)]\delta$. Now note that the measure of workers in the cohort with unknown match quality (but still employed by firm i) shrinks at rate $\delta + \phi$, whereas the measure of workers in the cohort with known match quality (and still employed by firm i) shrinks at a rate less than δ, since this measure is increased by the workers formerly of unknown match quality who are discovered to have high match quality. It follows that $q_i(\tau)$ strictly decreases with tenure and therefore the average wage of the cohort strictly increases with tenure and the average hazard rate of separation of the cohort strictly decreases with tenure. □

Having obtained the results of Jovanovic (1979) that are most important for our purposes, we turn to employee spinoff firms and the process by which they are formed.

2.3 Spinoff entrepreneurship and intrafirm social capital

An incumbent firm experiences an innovation shock at a Poisson rate 2θ. With probability one-half the shock results in a new idea that will lead a share of current workers at the firm to leave and start an employee spinoff firm. In this case, the parent firm survives and rehires workers to fill the vacancies. With probability one-half the shock is severe and results in firm exit. Hence spinoffs are created at a Poisson rate θ and incumbent firms exit at the same rate θ. We choose this setup of equal entry and exit rates so as to retain a constant measure of firms.

Now consider the entry of an employee spinoff. At Poisson rate θ a constant fraction γ of the employees in the parent firm gets an idea for a new firm. We will refer to these workers-turned-entrepreneurs as the *partners*. The partners are drawn with an equal chance from the employees with known and with unknown match quality.

Neither owners of firms nor the profits they receive are recorded in our data. Accordingly, we oversimplify the treatment of partners and profits in our model in order to make room for details in the parts of our model that address our data. We assume that the output market is perfectly competitive, which in combination with equations (1) and (2) ensures that all firms earn zero profits. In lieu of profits, each partner gets a flow value a from implementing the idea for the new firm, which we interpret as the monetary value of the utility of being one's own boss. We assume $a > \mu_H$ so that all ideas are implemented: an individual always prefers being a partner to being an employee. This would clearly be a bad assumption if our goal was to predict spinoffs. Fortunately, our predictions will only concern the contrast between a spinoff's hires from the parent and from elsewhere, on the one hand, and between those hires and the employees who remain at the parent, on the other.

Next consider the $(1-\gamma)$ employees in the parent firm who are not partners. Of these, a fraction α belongs to the *social network* of the partnership. These are the employees whose match qualities with the new firm are known to the partners. We assume that employees are randomly assigned to social networks at time of hiring. It follows that a share p_0 of the employees in the social network of the partnership will be high quality matches with the new firm. Intuitively, if my social network predates my idea for a new firm, I cannot select colleagues to be in my network based on their match quality with my new firm. Thus, when my idea arrives, the probability that a member of my social network is of high match quality is the same as for the general population of workers.

We assume that the partners succeed in recruiting an employee from the parent to their new firm if and only if they offer him a strictly better contract. It follows immediately that the spinoff firm hires $q_i(t)(1-\gamma)\alpha p_0$ employees from the parent firm, because they earn only $w(p_0)$ at the parent but they will earn $w(1) = \mu_H > w(p_0)$ at the spinoff. Note that the partnership cannot offer a better contract to any employee not in its social network, because it cannot offer a higher wage than the parent firm, nor can it offer a better contract to any employee of known match quality with the parent firm, because these employees already receive the highest possible wage $w(1) = \mu_H$ and will continue to receive $w(1)$ until exogenous separation occurs. In the empirical work below we call the employees recruited from the parent to the spinoff firm *team members*, and we consider these employees and the partners to constitute the *founding team* of the new firm.

Like any firm, the spinoff employs a unit mass of employees in total. It must therefore hire $1-q_i(t)(1-\gamma)\alpha p_0$ additional employees, drawing from the current pool of displaced employees who either worked for dissolved firms, exogenously separated from active firms, or endogenously quit active firms because of a revealed low match quality.[3] At hiring, the match quality of outside employees or *non-team members* is unknown and they receive a wage $w(p_0)$.

We conclude our description of the spinoff process by relaxing, for the sake of empirical realism, our assumption that social network members recruited to a planned spinoff firm are high quality matches for the new jobs with certainty. Instead we allow for *planning error* that could arise because, although the partnership envisions positions for everyone recruited for the spinoff for which they are perfect fits, the configuration of the new firm is uncertain and some of these positions may not turn out as conceived. In this case the unlucky recruits may or may not fit the positions that are actually available. Concretely, we assume that at the time of spinoff entry a share ε of employees who leave the parent to join the spinoff have the same probability of high match quality as workers hired from the outside, where ε is a random variable with support [0,1). The realization of ε is revealed to potential recruits at the time of spinoff hiring and can be thought of as a characteristic of the idea that initiates the firm. It matters only at birth of the firm, when it helps to determine the initial division of

[3] Applying the rule that recruiting employees from other firms requires offering a strictly better contract, we see that recruitment of team members from a parent to a spinoff firm is the only instance of "poaching" employees from other active firms that can occur in our model.

employees between known and unknown match quality.

To complete the specification of our model we describe unemployment. As in Moscarini (2005), any unemployed worker earns a flow value of b from home production or the informal sector. Vacancies to which an unemployed worker can be randomly matched appear at Poisson rate λ. b must be small enough that a worker will accept a new job when one becomes available, but large enough that an employee prefers to quit his current job when he is poorly matched. We derive the bounds on b for given λ in the next subsection. λ in turn is determined in general equilibrium so that the flow of employees out of unemployment equals the flow into unemployment, and is derived in Subsection 2.6 below.

2.4 Individual dynamics

Let P be an individual's value of being a spinoff partner, and $V(p_0)$, $V(1)$ be an individual's value of employment with unknown and known match quality, respectively. Workers in our data leave the formal sector for informal work, self employment or unemployment, so we allow for a status outside formal work and call its value U, an individual's value of unemployment. Denoting $\mathbb{E}[\varepsilon]$ by $\bar{\varepsilon}$, we can express the Bellman equations for an employee compactly as:

$$\begin{aligned} r\,V(p) &= w(p) - (\delta+\theta)\,[V(p)-U] \\ &\quad +\phi\,\{p\,[V(1)-V(p)] - (1-p)\,[V(p)-U]\} \\ &\quad +\theta\big\{\gamma\,[P-V(p)] \\ &\qquad +(1-\gamma)\alpha p_0 \max\left[0,(1-\bar{\varepsilon})V(1)+\bar{\varepsilon}V(p_0)-V(p)\right]\big\} \end{aligned} \tag{3}$$

with $p \in \{p_0, 1\}$, where

$$r\,U = b + \lambda[V(p_0) - U], \tag{4}$$

and

$$r\,P = a - \theta[P - U]. \tag{5}$$

We can solve these four equations in four unknowns conditional on the value of the vacancy rate λ. An intermediate step in the solution yields:

$$V(p_0) = \frac{w(p_0) + p_0[\phi + \theta(1-\gamma)\alpha(1-\bar{\varepsilon})]V(1) + \theta\gamma P + (\delta+\theta+(1-p_0)\phi)U}{r + p_0[\phi + \theta(1-\gamma)\alpha(1-\bar{\varepsilon})] + \theta\gamma + (\delta+\theta+(1-p_0)\phi)}, \tag{6}$$

$$V(1) = \frac{\mu_H + \theta\gamma P + (\delta+\theta)U}{r + \theta\gamma + (\delta+\theta)}, \tag{7}$$

$$U = \frac{b + \lambda V(p_0)}{r+\lambda}, \tag{8}$$

$$P = \frac{a + \theta U}{r+\theta}. \tag{9}$$

Equation (6) summarizes the vicissitudes to which a worker in our model is subject. When he is of unknown match quality, perhaps having just been matched randomly to a vacancy, he receives the expected wage $w(p_0)$ given by equation (2). With probability ϕp_0 he is recognized as having high match quality by his current employer and with probability $\theta(1-\gamma)\alpha p_0(1-\bar{\varepsilon})$ he is recruited by members of his social network into their new firm, for which they have accurately judged him to be of high match quality. With probability $\theta\gamma$, he is struck by an idea for a new firm himself. Finally, with probability $\phi(1-p_0)$ he is discovered to have low match quality with his current employer, with probability δ he is exogenously separated from his current employer, and with probability θ his current employer exits.

From equation (8), it is clear that for any value of λ there exists a value of b sufficiently low so that $U < V(p_0)$. We can freely choose this value of b such that $U > V(0)$ because $V(0) < V(p_0)$ and because λ is not a function of b in equilibrium (see Subsection 2.6).

The four equations (6)-(9) form a conventional linear system in the four unknowns $V(p_0)$, $V(1)$, U and P. The solutions are available on request.

2.5 Firm dynamics

As a consequence of gradual learning by employers, spinoff firms will rarely be able to recruit employees with long tenure. It does not follow, however, that spinoffs will be almost unable to recruit from long-established firms. Recalling that $q_i(t)$ is the proportion of employees in firm i of unknown match quality at time t, at any moment the flow of employees out of unknown into known status at firm i is given by $q_i(t)\,\phi\,p_0$. The flow of workers into unknown status is given by $(1-q_i(t))\,\delta + (1-q_i(t))\,\theta\gamma$.[4] It follows that the change in the fraction of workers with unknown match quality is

$$\dot{q}_i(t) = (1-q_i(t))\,\delta + (1-q_i(t))\,\theta\gamma - q_i(t)\,\phi\,p_0 \tag{10}$$

and it depends negatively on $q_i(t)$. Thus, from any initial value, $q_i(t)$ will ultimately converge to its steady state value q^*, where

$$q^* = (\delta + \theta\gamma)/(\delta + \theta\gamma + \phi\,p_0), \tag{11}$$

[4]To see this rigorously, observe that at any moment in time, an incumbent firm loses a measure δ of workers because of exogenous separation. These workers are instantaneously replaced with outside workers of unknown match quality. Among the separating workers, a measure $[1-q_i(t)]\delta$ was of known match quality at the firm so $q_i(t)$ increases at a rate $[1-q_i(t)]\delta$ from this flow. Similarly, an incumbent firm loses a measure $\theta\gamma$ of workers because they become partners of a spinoff, and those are also instantaneously replaced with outside workers of unknown match quality. So $q_i(t)$ increases at a rate $[1-q_i(t)]\theta\gamma$ from that flow. Note that the $q_i(t)\theta(1-\gamma)\alpha p_0$ social network members who choose to join a spinoff must have been of unknown match quality so they cause no net change to the measure of unknown match quality workers as they are replaced with new workers of unknown quality. Similarly, the $q_i(t)\phi(1-p_0)$ employees revealed to be low quality matches were of unknown match quality before so they also cause no net change to the measure of unknown match quality workers. Finally, a measure $q_i(t)\phi p_0$ of employees with unknown match quality is revealed to be high quality and continues employed at the firm, so that this measure reduces $q_i(t)$.

at which $\dot{q}_i(t) = 0$. As we expect, the steady state proportion of workers with unknown match quality increases with the exogenous separation rate δ and the rate of spinoff entrepreneurship $\theta\gamma$ and decreases with the rate of information arrival ϕ.

2.6 Closing the model

We assume that the total measure of individuals is $(1+\gamma)\bar{M}$, where $\bar{M}$ is the total measure of firms and γ is the constant fraction of partners in the population. The value functions imply optimal population flows between partnership, employee status, and unemployment.

Start with partnership. At any moment in time, a measure $\theta\gamma\bar{M}$ of employees turns into partners at a spinoff. On the other hand, the exogenous death rate of firms θ causes an outflow of $\theta\gamma\bar{M}$ from partnerships into unemployment at any given moment. Thus the net flow of individuals into and out of partnership is zero at any moment.

Consider unemployment next. A measure $\theta\gamma\bar{M}$ of individuals flows from partnerships into unemployment at any moment. A measure $(\delta+\theta)\bar{M}$ of workers is exogenously separated from employment while a measure $\phi(1-p_0)\bar{q}\bar{M}$ endogenously quits as their match quality is revealed to be low, where $\bar{q}$ is the economy-wide fraction of employees with unknown match quality.[5] For the economy to be in equilibrium, the flows into unemployment must be balanced by flows out of unemployment, yielding

$$\lambda = \theta(1+\gamma) + \delta + \phi(1-p_0)\bar{q}. \tag{12}$$

A similar argument applies to inflows and outflows from employment. A measure $\lambda\bar{M} = [\theta(1+\gamma)+\delta+\phi(1-p_0)\bar{q}]\bar{M}$ flows from unemployment into employee status at any moment. A measure $\theta\gamma\bar{M}$ of workers flows out of employment into partnerships at any moment, and a measure $(\delta+\theta)\bar{M}+\phi(1-p_0)\bar{q}\bar{M}$ of workers flows out of employment into unemployment at any moment.

Different unemployment levels are consistent with this equilibrium: for a total measure of $(1+\gamma)\bar{M}$ persons in the population, unemployment is zero. For a total measure of $(1+\gamma+u)\bar{M}$ persons in the population, the unemployment level is $u\bar{M}$, and u can be chosen arbitrarily.

2.7 Empirically testable predictions

In this draft we will be concerned with the predictions of our model for differences in survival at the spinoff firm between team members and non-team members. Note that these differences can only be computed conditional on survival of the spinoff firm itself. For the empirical analysis we find it convenient to work with the *survival hazards* of team members and non-team members, where the survival hazard equals one less the separation hazard. We

[5] $\bar{q}$ depends, of course, on the steady-state distribution of q across the population of firms. We will develop this distribution in a future draft, beginning with the solution to the non-homogenous differential equation (10).

define the *survival hazard gap* as the difference between the survival hazards of team and non-team members, conditional on survival of the spinoff firm that employs them.

We summarize our theoretical results in the following two propositions. The propositions present us with testable implications.

Proposition 1. *The survival hazard gap between team members and non-team members at time of hiring is positive and diminishes with tenure.*

Proof. Define $q_{i0}(\tau)$ as the proportion of the employee cohort with tenure τ that was of unknown match quality with firm i when it was founded (time 0) and that is still of unknown match quality. Note that $q_{i0}(0) = 1$. The average hazard rate of separation for this cohort is given by $q_{i0}(\tau)[\delta + \phi(1-p_0) + \theta(\gamma + (1-\gamma)\alpha p_0)] + [1-q_{i0}(\tau)](\delta + \theta\gamma) = \delta + \theta\gamma + q_{i0}(\tau)[\phi(1-p_0) + \theta(1-\gamma)\alpha p_0]$. This is the average separation hazard for non-team members, which we can denote by $s_n(\tau)$. The average separation hazard for team members is then given by $(1-\varepsilon)(\delta + \theta\gamma) + \varepsilon s_n(\tau)$. The difference between the average separation hazards for non-team and team members is easily shown to be $(1-\varepsilon)[s_n(\tau) - (\delta + \theta\gamma)] = (1-\varepsilon)q_{i0}(\tau)[\phi(1-p_0) + \theta(1-\gamma)\alpha p_0] > 0$. Moreover, using the same logic as in Lemma 1, we have $q'_{i0}(\tau) < 0$. □

Proposition 2. *As ε increases, the survival hazard gap between team members and non-team members at time of hiring decreases but the rate at which it diminishes with tenure also decreases.*

Proof. The difference between the average separation hazards for non-team and team members is given by $(1-\varepsilon)q_{i0}(\tau)[\phi(1-p_0) + \theta(1-\gamma)\alpha p_0]$ and the rate at which it diminishes with tenure is given by $(1-\varepsilon)q'_{i0}(\tau)[\phi(1-p_0) + \theta(1-\gamma)\alpha p_0]$. The results follow immediately. □

3 Data

Our data derive from the linked employer-employee records RAIS (*Relação Anual de Informações Sociais* of the Brazilian labor ministry *MTE*), which record comprehensive individual employee information on occupations, demographic characteristics and earnings, along with employer identifiers. By Brazilian law, every private or public-sector employer must report this information every year.[6] De Negri, Furtado, Souza and Arbache (1998) compare

[6]RAIS primarily provides information to a federal wage supplement program (*Abono Salarial*), by which every employee with formal employment during the calendar year receives the equivalent of a monthly minimum wage. RAIS records are then shared across government agencies. An employer's failure to report complete workforce information can, in principle, result in fines proportional to the workforce size, but fines are rarely issued. In practice, employees and employers have strong incentives to ascertain complete RAIS records because payment of the annual public wage supplement is exclusively based on RAIS. The ministry of labor estimates that well above 90 percent of all formally employed individuals in Brazil are covered in RAIS throughout the 1990s. Data collection is typically concluded by March following the year of observation.

labor force information in RAIS to that in a main Brazilian household survey (PNAD) and conclude that, when comparable, RAIS delivers qualitatively similar results to those in the national household survey. Menezes-Filho, Muendler and Ramey (2008) apply the Abowd, Kramarz, Margolis and Troske (2001) earnings-estimation methodology to Brazil and show that labor-market outcomes from RAIS broadly resemble those in France and the United States, even after controlling for selection into formal-sector employment, except for unusually high returns to high school and college education and to experience among males. Appendix A in HMR presents further details on the data source.

A job observation in RAIS is identified by the employee ID, the employer's tax ID (CNPJ), and dates of job accession and separation. To avoid double-counting employees at new firms, we keep only one observation for each employer-employee pair, choosing the job with the earliest hiring date. If the employee has two jobs at the firm starting in the same month, we keep the highest paying one. The rules on tax ID assignments make it possible to identify new firms (the first eight digits of the tax ID) and new plants within firms (the last six digits of the tax ID). Appendix A discusses the relevant details on tax ID assignment. Our data include 71.1 million employees (with 556.3 million job spells) at 5.52 million plants in 3.75 million firms over the sixteen-year period 1986-2001 in any sector of the economy. We limit our attention to the years 1995-2001 to ensure that firms we label as new have not operated before, using the years 1986-1994 to identify the universe of entrants between 1995 and 2001 and the observations between 1995 and 2001 for our economic analysis. RAIS offers detailed industry information (at the four-digit *CNAE* level) starting in 1995. During this 7-year period, 1.54 million new firms and 2.17 million plants entered (of which 581 thousand new plants were created within incumbent firms). By 1995 macroeconomic stabilization had succeeded in Brazil. The Plano Real from August 1994 had brought inflation down to single-digit rates. Fernando Henrique Cardoso, who had enacted the Plano Real as Minister of Finance, became president, signalling a period of financial calm and fiscal austerity. Apart from a large exchange-rate devaluation in early 1999 and a subsequent switch from exchange-rate to inflation-targeting at the central bank, macroeconomic conditions remained relatively stable for the following years.

4 Survival Hazard Results

In order to test our predictions it is crucial that we successfully identify employee spinoff firms and their parents. HMR restrict their attention to new firms with at least five employees and use the criterion that if at least one quarter of the workers at a new firm previously worked for the same existing firm, the new firm is an employee spinoff and the existing firm is its parent. However, if this new firm absorbed at least seventy percent of the workers in one of the parent's plants and has a legal form such that it could be owned by the parent, HMR classify it as a divestiture rather than a spinoff. HMR find that the performance of spinoffs is superior to new firms without parents but inferior to divestitures. In particular,

Table 1: SURVIVAL GAP OF TEAM VERSUS OTHER WORKERS

	All workers					
Share of retained workers	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$	$t+6$
OLS	(1)	(2)	(3)	(4)	(5)	(6)
Team member	.062	.101	.059	.045	.042	.024
	(.001)***	(.002)***	(.003)***	(.004)***	(.005)***	(.009)***
Const.	.706	.594	.705	.752	.795	.804
	(.002)***	(.003)***	(.004)***	(.004)***	(.005)***	(.006)***
Obs.	148,580	101,616	57,270	30,772	13,878	5,208
R^2 (overall)	.044	.052	.028	.033	.054	.092
Mean Dep. variable	.769	.649	.731	.774	.806	.816
CNAE industry panels	540	526	511	480	428	343
Cohort panels	6	5	4	3	2	1

Source: RAIS 1995-2001, employee spinoff firms with at least one non-team member at time of entry.
Notes: Definition of employee spinoff (quarter-workforce criterion) as described in HMR. Two observations per employee spinoff firm, one for team members and one for non-team members. All specifications condition on the spinoff firm's *CNAE* industry and cohort fixed effects. Robust standard errors in parentheses: * significance at ten, ** five, *** one percent.

HMR document that size at entry is larger for employee spinoffs than for new firms without parents but smaller than for divestitures, and that subsequent exit rates for employee spinoffs are smaller than for new firms without parents but larger than for divestitures. These results are consistent with the interpretation that some part of a parent firm's productivity draw in the Jovanovic (1982) model is embodied in its employees and portable by them to a new firm. We will use HMR's criteria to distinguish employee spinoffs from new firms without parents and from divestitures. By these criteria, roughly 30 percent of new Brazilian firms in the period 1995-2001 with at least five employees are employee spinoffs.

We begin by testing our first prediction (Proposition 1) that team members are more likely than non-team members to stay with a spinoff firm from one year to the next, with the gap in the survival hazard diminishing with worker tenure. In an alternative, perfect information world, it is hardly likely that entrepreneurs would find the best workers for their new firm among the relative handful available at their current employer. They might nevertheless choose them to conserve on upfront hiring costs, and gradually replace them with better workers as their firm matures. Muendler and Rauch (2009) present evidence that, when locating customers and inputs, spinoff firms remain geographically closer to their parents than new plants that a parent sets up within the firm, which is consistent with a desire to reduce hiring costs by recruiting from the parent.

Table 1 shows linear regressions where the dependent variable is the proportion of workers, divided between team members and others, who remain employed at a spinoff firm from

one year to the next.[7] Note that all these employees joined the new firm in the same year. The key explanatory variable is an indicator for team members.[8] The control variables are indicators for four-digit *CNAE* industry and firm birth cohort (1995-2000). Focusing on the second column, we see that for workers hired at startup who have survived with the firm for one year, the proportion of team members that survives for a second year is 10.1 percentage points greater than the proportion of non-team members that survives for a second year. This difference declines monotonically with worker tenure from a firm's second year through its sixth year of existence. The constant term, which one can interpret as the survival hazard rate for non-team members, steadily increases from the second through sixth year.

The results in Table 1 are strongly supportive of Proposition 1, except for the increase in the survival hazard gap from the first to the second year of employment. This increase is driven by the fall in the survival hazard rate for non-team members (the constant term), so it appears that the failure of Lemma 1 to hold between the first and second year is the underlying cause of this only failure of Proposition 1. However, the behavior of the constant term in Table 1 is entirely consistent with the well-known tendency for separation hazard rates to rise at the very beginning of employment before falling (e.g. Farber 1994). We conjecture that addition to our model of a "grace period" before an employer attaches any importance to observations of performance for some workers would eliminate the discrepancy between our predictions and the results in Table 1.[9]

The number of observations in Table 1 decreases sharply as we progress from $t+1$ to $t+6$. This occurs for three reasons. First, for each additional year over which we measure survival, we lose a cohort of firms. Second, within any cohort the number of firm exits increases with time.[10] Third, even if a firm survives it may lose all its team members, all its other startup workers, or both. It is possible that, contrary to our model, firms that are "heading for the exit" behave differently regarding retention of employees, and we will investigate this possibility in a future draft.

Cumulatively, after five years team members are 52 percent more likely to remain with the spinoff firm than non-team members. This is computed by replacing the proportions of workers that survive from one year to the next with the proportions of workers hired at founding that survive as the dependent variable in Table 1, and taking the ratio of the coefficient on the team indicator to the constant term in the $t+5$ column.

[7] For our model applies to permanent rather than temporary separation, any worker who is still with the firm at the end of our sample period (2001) is counted in the numerator, even if he is not with the firm in one or more intervening years.

[8] If the partners from our model choose to pay themselves salaries and therefore incur payroll taxes, they will be recorded as team members in our data. We believe that this rarely happens, but in a future draft we will exclude team members with occupations coded as director or manager as a robustness check.

[9] The ability to explain an initial rise in the separation hazard is the only empirically substantive loss resulting from our simplification of the employer learning model of Jovanovic (1979).

[10] We remove any exiting firm from our sample in its first year of exit, since otherwise the proportion of surviving employees would be computed to be zero for both team and non-team members for that firm in that year.

Table 2: SURVIVAL GAP CONDITIONAL ON PARENT INDUSTRY OVERLAP

	All workers					
Share of retained workers	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$	$t+6$
OLS	(1)	(2)	(3)	(4)	(5)	(6)
Team member	.072	.117	.066	.052	.046	.030
	(.002)***	(.003)***	(.004)***	(.006)***	(.008)***	(.014)**
Different *CNAE*	-.003	.011	.0006	.014	-.003	.003
	(.002)	(.003)***	(.005)	(.006)**	(.009)	(.016)
Team member × Different *CNAE*	-.022	-.033	-.015	-.016	-.010	-.015
	(.003)***	(.005)***	(.006)**	(.008)*	(.012)	(.019)
Const.	.710	.579	.699	.743	.796	.805
	(.003)***	(.004)***	(.005)***	(.006)***	(.007)***	(.011)***
Obs.	120,886	83,028	46,578	24,938	11,222	4,128
R^2 (overall)	.047	.057	.031	.037	.064	.106
Mean Dep. variable	.771	.642	.731	.771	.805	.817
CNAE industry panels	532	519	500	472	411	317
Cohort panels	6	5	4	3	2	1

Source: RAIS 1995-2001, employee spinoff firms with at least one non-team member at time of entry.
Notes: Definition of employee spinoff (quarter-workforce criterion) as described in HMR. Two observations per employee spinoff firm, one for team members and one for non-team members. All specifications condition on the spinoff firm's *CNAE* industry and cohort fixed effects. Different *CNAE* from parent is only defined for those spinoff firms having (i) a non-missing mode *CNAE*, (ii) a surviving parent firm at birth t, and (iii) a parent firm with non-missing mode *CNAE*. Robust standard errors in parentheses: * significance at ten, ** five, *** one percent.

Turning to our second prediction (Proposition 2), we want to compare the survival hazard gaps between spinoff firms with different planning errors (realizations of ε). It is reasonable to think that the likelihood of such mistakes is greater, the more different is the new enterprise from its parent. Table 2 adds to each column of Table 1 an indicator that equals one if the employee spinoff is in a different four-digit *CNAE* industry from the parent firm (which happens in about half of all cases), and the interaction between this indicator and the indicator for team members. The coefficient on the interaction is always negative and is statistically significant from $t+1$ to $t+4$, which strongly supports the prediction of Proposition 2 of a reduction in the survival hazard gap between team and non-team members at time of hiring. Proposition 2 also predicts that this reduction should decrease (in absolute value) with worker tenure. The coefficient on the interaction in Table 2 does decrease in absolute value after the second year of employment, but the decrease is not monotonic. The increase in the absolute value of the coefficient from the first to the second year is consistent with the already-noted failure of Lemma 1 to hold between the first and second year, and we conjecture that it will also be explained by the modification of our employer learning model suggested above.

Table 3: SURVIVAL GAP CONDITIONAL ON PARENT INDUSTRY OVERLAP, TRACKABLE WORKERS ONLY

	All workers					
Share of retained workers	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$	$t+6$
OLS	(1)	(2)	(3)	(4)	(5)	(6)
Team member	.070	.115	.063	.045	.041	.035
	(.002)***	(.004)***	(.005)***	(.007)***	(.009)***	(.015)**
Different *CNAE*	-.001	.009	-.002	.020	-.00008	.010
	(.003)	(.004)**	(.005)	(.007)***	(.011)	(.017)
Team member × Different *CNAE*	-.023	-.031	-.011	-.022	-.013	-.020
	(.003)***	(.005)***	(.007)	(.009)**	(.013)	(.021)
Const.	.714	.579	.703	.746	.798	.798
	(.003)***	(.004)***	(.005)***	(.006)***	(.008)***	(.012)***
Obs.	114,768	76,538	40,786	21,294	9,512	3,496
R^2 (overall)	.042	.052	.031	.038	.071	.120
CNAE industry panels	529	517	496	461	394	300
Cohort panels	6	5	4	3	2	1

Source: RAIS 1995-2001, employee spinoff firms with at least one non-team member at time of entry. Trackable-workers subsample only includes observations of trackable workers among non-team workers (team workers are trackable by definition).
Notes: Definition of employee spinoff (quarter-workforce criterion) as described in HMR. Two observations per employee spinoff firm, one for team members and one for non-team members. All specifications condition on the spinoff firm's *CNAE* industry and cohort fixed effects. Different *CNAE* from parent is only defined for those spinoff firms having (i) a non-missing mode *CNAE*, (ii) a surviving parent firm at birth t, and (iii) a parent firm with non-missing mode *CNAE*. Robust standard errors in parentheses: * significance at ten, ** five, *** one percent.

A potential bias in Tables 1 and 2 arises because workers other than team members do not necessarily have previous formal sector experience, i.e., we may not have been able to track the non-team members to previous formal sector jobs. Perhaps workers who are not trackable are less likely to survive in a formal sector firm. In Table 3 we therefore drop all non-team members who are not trackable from Table 2. (Team members are trackable by definition.) Our results change little.

Many employee characteristics determine the quality of his match to a job. There is his mix of "fundamental" characteristics such as carefulness, friendliness, intelligence, manual dexterity, perseverance, reliability, etc. For some jobs there are also specialized skills not everyone can acquire, such as operating a certain machine tool or programming a certain computer language. A spinoff firm may need the same set of specialized skills as its parent, and in a thin labor market it may be hard to find applicants with these skills besides those employees the spinoff can attract from the parent. As a proxy for availability in the local

Table 4: SURVIVAL GAP CONDITIONAL ON LOCAL LABOR MARKET THICKNESS

	All workers					
Share of retained workers	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$	$t+6$
OLS	(1)	(2)	(3)	(4)	(5)	(6)
Team member	.085	.075	.042	.043	.019	.063
	(.005)***	(.008)***	(.010)***	(.014)***	(.019)	(.031)**
Different *CNAE*	-.002	.008	-.003	.012	-.008	.002
	(.002)	(.003)**	(.005)	(.007)*	(.010)	(.016)
Team member × Different *CNAE*	-.023	-.029	-.012	-.015	-.007	-.019
	(.003)***	(.005)***	(.006)**	(.008)*	(.012)	(.019)
Log Empl. same *CNAE* & municip.	.002	-.004	-.005	-.002	-.006	-.001
	(.0005)***	(.0007)***	(.001)***	(.001)*	(.002)***	(.003)
Tm. mbr. ×Log Emp. *CNAE* & mun.	-.002	.006	.003	.001	.003	-.004
	(.0006)***	(.0009)***	(.001)***	(.002)	(.002)	(.004)
Const.	.698	.611	.738	.762	.842	.815
	(.005)***	(.007)***	(.009)***	(.012)***	(.017)***	(.027)***
Obs.	120,884	83,028	46,578	24,938	11,222	4,128
R^2 (overall)	.047	.057	.032	.037	.065	.107
CNAE industry panels	532	519	500	472	411	317
Cohort panels	6	5	4	3	2	1

Source: RAIS 1995-2001, employee spinoff firms with at least one non-team member at time of entry. Trackable-workers subsample only includes observations of trackable workers among non-team workers (team workers are trackable by definition).

Notes: Definition of employee spinoff (quarter-workforce criterion) as described in HMR. Two observations per employee spinoff firm, one for team members and one for non-team members. Log employment in same *CNAE* and municipality is the log number of workers in the birth year of the spinoff firm with formal employment in the same municipality and same industry as the spinoff. All specifications condition on the spinoff firm's *CNAE* industry and cohort fixed effects. Different *CNAE* from parent is only defined for those spinoff firms having (i) a non-missing mode *CNAE*, (ii) a surviving parent firm at birth t, and (iii) a parent firm with non-missing mode *CNAE*. Robust standard errors in parentheses: * significance at ten, ** five, *** one percent.

labor market of workers with relevant skills acquired on the job, we compute the number of workers in the birth year of the spinoff firm who are in the same municipality and same industry.[11] In Table 4, we add the log of this number and its interaction with the team member indicator to the explanatory variables in Table 2. If the survival hazard gap between team members and non-team members is driven by the inability of the partners to find non-team members with relevant on-the-job skills, the coefficient on the interaction term should be negative. Instead, we see that this coefficient is positive and statistically significant in the second and third years of employment and negative and statistically significant only in the first year of employment. Note that the direct effect on the survival hazard of the log of the number of workers in the same municipality and same industry as the spinoff firm is typically negative and statistically significant, which we interpret to mean that this is a good measure of labor market thickness.

In our model the innovation shock to an incumbent firm either results in a spinoff or in exit. We do not consider an intermediate possibility, where the shock causes a spinoff and weakens the parent so that its future exit rate rises above θ. In this empirically relevant case the prediction of our model that a spinoff firm will not be able to attract workers from the parent firm who have already been identified as high quality matches for the parent may no longer hold. This could reduce planning error, since any of these workers in the social network of the partnership will have been there longer on average, and therefore raise the estimated survival hazard gap. Alternatively, parent exit makes it impossible for team members to return to their old jobs, something that will not happen in our model but is observed in our data.

In Table 5, we add to Table 2 an indicator for survival of the parent of the spinoff firm through 2001, the last year in our data, and the interaction of that indicator with the indicator for team member. There is some indication that the survival hazard gap is reduced for spinoff firms whose parents are still observed in 2001 relative to those whose parents have exited, but the support for Propositions 1 and 2 remains unchanged.

In Table 6 we push this point further by dropping from our sample all spinoff firms whose parents have not survived through 2001. We also add a variable clearly ruled out by our model, a proxy for the productivity of the parent firm relative to the spinoff firm: the log of the ratio of parent employment in the year before the spinoff to spinoff employment at birth. This variable is entered directly and in interaction with the team member indicator. If the ability to recruit employees from the parent is driven by high productivity relative to the parent rather than by superior knowledge of match quality, the coefficient on the interaction term should be negative. We see in Table 6 that this coefficient is negative and significant only for the first year of employment and is mostly positive and insignificant thereafter. Support for Propositions 1 and 2 remains strong.

Much remains to be done. We have yet to exploit the information in RAIS on employee characteristics. For example, we will control for the possibility that team and non-team

[11] In a future draft we will also compute this number using the same industry as the parent firm instead of the spinoff firm.

Table 5: SURVIVAL GAP CONDITIONAL ON PARENT SURVIVAL

	All workers					
Share of retained workers	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$	$t+6$
OLS	(1)	(2)	(3)	(4)	(5)	(6)
Team member	.085	.125	.072	.056	.033	.045
	(.003)***	(.004)***	(.006)***	(.008)***	(.011)***	(.018)**
Different *CNAE*	-.002	.010	-.0007	.013	-.002	-.001
	(.002)	(.003)***	(.005)	(.006)**	(.010)	(.016)
Team member × Different *CNAE*	-.018	-.031	-.014	-.015	-.013	-.011
	(.003)***	(.005)***	(.006)**	(.008)*	(.012)	(.019)
Parent observed in 2001	-.009	.011	.010	.008	-.013	.029
	(.002)***	(.003)***	(.005)**	(.007)	(.010)	(.017)*
Team member × Parent obs. 2001	-.024	-.015	-.010	-.008	.022	-.028
	(.003)***	(.005)***	(.006)	(.009)	(.013)*	(.020)
Const.	.714	.573	.693	.739	.803	.788
	(.003)***	(.004)***	(.005)***	(.007)***	(.009)***	(.015)***
Obs.	120,886	83,028	46,578	24,938	11,222	4,128
R^2 (overall)	.049	.057	.031	.037	.064	.107
CNAE industry panels	532	519	500	472	411	317
Cohort panels	6	5	4	3	2	1

Source: RAIS 1995-2001, employee spinoff firms with at least one non-team member at time of entry.
Notes: Definition of employee spinoff (quarter-workforce criterion) as described in HMR. Two observations per employee spinoff firm, one for team members and one for non-team members. All specifications condition on the spinoff firm's *CNAE* industry and cohort fixed effects. Different *CNAE* from parent is only defined for those spinoff firms having (i) a non-missing mode *CNAE*, (ii) a surviving parent firm at birth t, and (iii) a parent firm with non-missing mode *CNAE*. Robust standard errors in parentheses: * significance at ten, ** five, *** one percent.

members differ systematically by characteristics known to influence survival hazard rates.

5 Next Steps

We will investigate the predictions of our model regarding tenure at the parent firm of workers who leave for the spinoff versus those who do not. Those who leave should be less likely to have been with the parent a very short or a very long time: the partnership needs time to get to know them, but too much time makes it likely that co-workers are known to be of high match quality with the parent.

Table 6: SURVIVAL GAP CONDITIONAL ON PARENT SURVIVAL

	All workers					
Share of retained workers	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$	$t+6$
OLS	(1)	(2)	(3)	(4)	(5)	(6)
Team member	.079	.112	.062	.056	.039	.021
	(.003)***	(.005)***	(.007)***	(.010)***	(.014)***	(.022)
Different *CNAE*	.0009	.012	-.003	.011	.004	-.007
	(.003)	(.004)***	(.006)	(.009)	(.013)	(.021)
Team member × Different *CNAE*	-.012	-.035	-.015	-.028	-.002	-.015
	(.004)***	(.006)***	(.008)*	(.011)***	(.015)	(.024)
Log size ratio	-.002	-.0007	.003	.005	-.002	-.003
	(.0007)**	(.001)	(.001)**	(.002)**	(.003)	(.005)
Team member × Log size ratio	-.009	.0002	.0003	.0002	.003	-.0001
	(.001)***	(.001)	(.002)	(.002)	(.003)	(.005)
Const.	.704	.583	.705	.742	.796	.833
	(.004)***	(.005)***	(.007)***	(.009)***	(.012)***	(.017)***
Obs.	76,932	51,318	28,724	15,392	7,012	2,516
R^2 (overall)	.054	.063	.041	.053	.08	.155
Mean Dep. variable	.771	.642	.731	.771	.805	.817
CNAE industry panels	520	506	472	435	353	262
Cohort panels	6	5	4	3	2	1

Source: RAIS 1995-2001, employee spinoff firms with at least one non-team member at time of entry.
Notes: Definition of employee spinoff (quarter-workforce criterion) as described in HMR. Two observations per employee spinoff firm, one for team members and one for non-team members. All specifications condition on the spinoff firm's *CNAE* industry and cohort fixed effects. Different *CNAE* from parent is only defined for those spinoff firms having (i) a non-missing mode *CNAE*, (ii) a surviving parent firm at birth t, and (iii) a parent firm with non-missing mode *CNAE*. The log size ratio is the log of the ratio of parent employment in the year before the spinoff to spinoff employment at birth. Robust standard errors in parentheses: * significance at ten, ** five, *** one percent.

Appendix

A Firm Identifiers

Consistent application of firm identifiers is crucial for our identification of new plants and firms. Plant-level information in RAIS is based on the CNPJ identification number, where CNPJ ('cadastro nacional de pesso juridica') stands for Brazil's national register of legal juristic persons. The first eight digits of CNPJ numbers (CNPJ radical) define the firm and the subsequent six digits the plant/branch within the firm. The CNPJ number is assigned or extinguished, and pertaining register information updated, under legally precisely defined conditions.

The CNPJ number is administered by the Brazilian tax authority Receita Federal, the Brazilian equivalent to the U.S. IRS. In the CNPJ register, Receita Federal maintains information related to the firm's legal form and related matters, which is separately also recorded in RAIS. The following nine types of transactions either trigger the creation or extinction of CNPJ numbers, or updating of the register while maintaining CNPJ numbers. Once extinguished, a CNPJ number cannot be reassigned to any other plant in the future.

1. *Opening a business, becoming a juristic person.* Obtain CNPJ. It is required of any juristic person ('pessoa juridica') in Brazil, a legal entity in Brazilian common and commercial law, to register a CNPJ number with the Receita Federal upon opening a business.[12]

2. *Change in business name ('nome empresarial'), or business sector ('porte da empresa'), or legal form ('*natureza juridica*').* Maintain CNPJ, update register information. Changes from individual entrepreneurs to associations or partnerships of entrepreneurs and owners, or the reverse, do not result in reported changes in legal form.

3. *Change in ownership ('quadro de sócios') at associations and partnerships, or change in management ('administradores'), or change in equity holding at associations and partnerships ('inclusão e alteração de capital social').* Maintain CNPJ, update register information. Note that changes to incorporated firms—juristic persons with independent legal existence such as a limited liability company ('sociedade por quotas de responsabilidade limitada')—are treated differently, see 8 below.

4. *Other changes to the register, including mothballing ('interrupção temporária de atividades') and resumption of operations ('reinício das atividades interrompidas temporariamente'), a change in tax status ('opção ou exclusão do simples', 'qualificação*

[12]There is also a set of legal entities that are not formally juristic persons but are put on equal legal footing with juristic persons by Receita Federal, including real estate condominiums, mutual funds, employer consortia, and foreign consulates.

tributária'), a change of responsible physical person (human being) for the CNPJ juristic person ('pessoa física responsável perante o CNPJ'), and several other administrative cases. Maintain CNPJ, update register information.

5. *Bankruptcy and liquidation.* Maintain CNPJ, update register information. It pertains to the Receita Federal to administer the CNPJ of the extinguished juristic person. Liquidation may be by court order or extrajudicial settlement. The opening and closing of a bankruptcy case must be reported.

6. *Opening new plants/branches.* New plants or branches are registered with the individual CNPJ numbers, where the first eight digits (CNPJ radical) define the firm and the subsequent six digits the plant/branch within the firm.

7. *Partial divestiture/corporate spinout ('cisão parcial').* Maintain CNPJ, update register information. The newly independent firm (divestiture or spinout) receives an own CNPJ. In practice, a partial divestiture might coincide with the acquisition of an individual plant by another firm.

8. *Merger of firm with other firm ('fusão'), acquisition of firm by other firm ('incorporação') or complete divestiture/corporate spinout into newly independent firms ('cisão total').* Extinguish CNPJ of firm that undergoes change. In the case of mergers and complete divestitures, the newly independent firm(s) obtain CNPJ(s) of their own. In the case of a plant acquisition, if the divested plant is not incorporated as a firm, the acquiring firm's CNPJ radical is retained and six new digits for the new plant are added. Note that the above applies to the acquisition of the firm as a whole, not select plants within the firm (for those cases see 7).

9. *Inactivity since day of foundation ('empresa que não iniciou atividades (inativa desde a abertura)').* Extinguish CNPJ.

Important for employee spinoffs, a change in ownership at associations or partnerships does not result in a change in CNPJ, as explained under item 3. Divestitures include both management-initiated offspring that become standalone firms (corporate spinouts or complete splitups ('cisão total')) and management-initiated offspring from parent firms' M&A activity (such as a merger ('fusão'), an acquisition ('incorporação'), and a partial splitup ('cisão parcial')). These are covered under items 7 and 8.

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