WHAT DO I TAKE WITH ME:

THE IMPACT OF TRANSFER AND REPLICATION OF RESOURCES ON PARENT AND SPIN-OUT FIRM PERFORMANCE

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Abstract

Focusing on entrepreneurial ventures created by employees leaving a firm, our study examines the differential impact of knowledge transfer and knowledge spillovers on both parent and spin-out performance. While extant research often uses knowledge transfer and spillover interchangeably, our study distinguishes between the two based on the “rivalness” of the relevant knowledge. We theorize that both knowledge transfer (proxied by the size of the exiting employee team) and knowledge spillovers (proxied by the experience of the exiting employee team) will aid spin-out performance. However, knowledge transfer, being more rival, will have a greater adverse impact than knowledge spillovers on parent firm performance. Using U.S. Census Bureau linked employee-employer data from the legal services industry, we find support for our hypotheses. Our study thus contributes to extant literature by highlighting a key dimension of knowledge — rivalness — and the differential competitive dynamics effect of resources with varying degrees of rivalness.

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Extant work on spin-outs—start-ups founded by a former employee of an established firm within the same industry—underscores the beneficial performance effects of knowledge transfer and spillovers from the parent firm with founders as knowledge conduits (Agarwal et al. 2004, Klepper and Sleeper 2005, Phillips 2002). In related work, scholars have also documented the adverse affects of employee mobility and spin-outs on parent firms (Aime et al. 2010, Campbell et al. 2010, Phillips 2002, Somaya et al. 2008, Wezel et al. 2006). However, Agarwal, Audretsch and Sarkar (2010) note that existing research on spin-out and parent firm performance treat knowledge transfer and spillovers as equivalent. Theoretically, the impacts of knowledge transfer and spillover are different (Mas-Colell et al. 1995, Samuelson 1954). While knowledge has traditionally been posited to have the property of non-rivalness in consumption (Arrow 1962), knowledge embedded in human assets can vary in degree of rivalness. Knowledge transfer, such as the movement of knowledge that is specific to individual human assets, represents a loss to the parent firm of rival assets, and knowledge spillover, such as the duplication of organizational procedures, and routines that are not specific to an individual, represents a replication of non-rival assets that allows both firms access to these assets. Thus, when studying the competitive dynamics between parent and spin-out firms, the following research question arises: Is there a differential impact of transfer versus replication of knowledge on parent and spin-out firm performance?

Our work aims to address this question. By comparing the effects of resources that vary in their degree of rivalness, we demonstrate that parent firms are affected differentially depending on whether the resources acquired by their spin-outs are more or less rival. By studying the impact on both parents and spin-outs, we examine whether the transfer of more rival resources benefits spin-outs, but adversely affects parent firms, and if the replication of more non-rival resources represents a pareto-improvement where their replication provides a benefit to the spin-out without a corresponding loss to the parent firm. This distinction adds to the understanding of the role of knowledge transfer and replication in the spin-out process. Further, the question of how the nature of these assets impacts performance is crucial to our understanding of competitive patterns within strategic management and entrepreneurship, not only from the micro perspective of an employee's ability to create and capture value from their knowledge, but also from the macro perspective of a firm's human resource management and the effect on its competitive advantage.

We examine our research question in the empirical context of the legal services industry - a professional context where knowledge residing in human assets and in complementary organizational routines and procedures is critical for the creation and appropriation of value. This is an ideal industry in which to examine employee entrepreneurship because, conditional on having a law degree, the costs associated with a new firm entering this industry are low relative to other industries. In addition, most firms are started by former employees rather than recent law school graduates, suggesting that organizational capital acquired at previous employers is valuable in new firms. Using a custom data extract of the Longitudinal Employer-Household Dynamics (LEHD) Project at the U.S. Census Research Data Center, we test to see how the mobility of resources that vary in terms of rivalry affects performance of parent organizations and spin-outs.

Consistent with prior work (e.g. Wezel et al. 2006), we proxy for resources with greater degree of non-rivalness—such as routines—with average work experience in the parent firm of the exiting founding team. We proxy for relatively more rival resources such as human capital by using the average founding team size, since these team members physically exit the parent firm to join the spin-out firm. Importantly, we control for the quality and quantity of the people leaving the parent firm.[2] We find that while the average founding team size has a negative and significant impact on the parent firm, the average work experience of the exiting founding team does not have a significant impact on the parent firm. Notably, even though we use comparable measures, these results are in contrast to prior work which suggested that the replication of routines has a negative effect on the parent (Phillips 2002, Wezel et al. 2006). We also confirm that the spin-out benefits from both the parent firm experience of the founding team and the founding team's size. These findings are consistent with the competitive effects of the transfer of rival resources and pareto-improving effects of the replication of non-rival resources. Since replication of routines is often associated with product market competition between rivals (Aime et al. 2010, Wezel et al. 2006), these findings suggest an asymmetry between factors that affect resource markets and factors that affect product markets. We subject our results to a multitude of robustness tests including a variety of alternative specifications for measures of the rival and non-rival resources.

[2] In other words, our team size measure thus captures the extent to which moving as a team has an effect over and above the same number and quality of people moving individually.

Our study contributes to strategic entrepreneurship and strategy research on routines. We provide an important complement to prior work (Phillips 2002, Wezel et al. 2006, Aime et al. 2010, Campbell et al. 2010) by examining simultaneously, rather than in isolation, the effect on parent and spin-out performance due to the transfer or replication of resources. We attempt to disentangle the drivers of the Schumpeterian creative destruction of parent firms brought by the creation of spin-outs. Our results also highlight the importance of replicating routines for spin-outs, but that such knowledge replication may not hurt the parent firm as much, relative to other resources.

Theoretical Framework

Extant research points to the beneficial effect of employee entrepreneurship on spin-out performance (Agarwal 2004, Chatterjee 2009, Franco and Filson 2006, Klepper and Sleeper 2005, Phillips 2002) and its negative effect on parent firm performance (Phillips 2002, Wezel et al. 2006, Aime et al. 2010, Campbell et al. 2010). The positive performance consequences for spin-outs have been attributed to the inheritance, through founders' knowledge, of technological and market pioneering capabilities (Agarwal et al. 2004), or to other relevant knowledge such as embeddedness within social networks (Burton 2002) and those related to the process of managing clinical trials (Chatterji 2009). The negative performance consequences for parent firms have also been linked to the quality of the founders: parent performance is found to decline with the rank (Phillips 2002) and earnings (Campbell et al. 2010) of exiting employee entrepreneurs within the parent organization.

In addition to the founders' knowledge, prior work has also highlighted the importance of complementary resources to either parent or spin-out firm performance. Brand reputation and client relationships (Phillips 2002), supporting team members (Groysberg et al. 2009), information on organizational routines (Wezel et al. 2009) and access to social networks related to suppliers, complementary products and customers (Burton 2002) have been identified as important factors impacting performance. However, existing research has not differentiated the degree of rivalness of the founders' knowledge and related complementary assets, and whether resources that are more rival represent greater performance advantages for spin-out firms, and disadvantage for parent firms.

Rival assets can only be used by one firm at any point in time, while non-rival assets can be used by multiple firms simultaneously (Mas-Colell et al. 1995, Samuelson 1954). For example, employee mobility makes the individual-specific knowledge of the employee unavailable to their former employer, including access to the resources embedded in the individual's social networks, relationships with clients, knowledge of markets and opportunities. However, the mobility of employees can also enable replication of non-rival assets such as routines, procedures, and other organizational capital which result in competitive parity in product markets (Aime et al. 2010, Wezel et al. 2006). These assets are available to both firms after the creation of the spin-out. Specifically, when employees follow an entrepreneur from parent firm A to spin-out B, they may replicate A's routines, and procedures in spin-out B while A continues to use those routines and procedures, but only spin-out B has access to the employees' individual-specific knowledge. Since both parent and spin-out firms compete in the same resource and product landscape after the formation of new venture by employees, there may be a differential performance ramification of transfer relative to that of replication of resources on both parent and spin-out performance.

Transfer of Rival Resources

Among the resources discussed above, the individual-specific knowledge of the departing employees represents the resource with the highest degree of rivalness. This rival resource includes the tacit knowledge possessed by each departing employee, as well as the personal relationships with suppliers, complementors and clients that they are able to take with them. We argue that the larger the team of individuals leaving a firm to join a spin-out, the greater is the transfer of rival resources which favors the spin-out while negatively impacting the parent firm.

The size of the team represents a greater transfer of rival resources due to both a simple additive effect of the resources of each individual team member, and due to synergies and complementarities within the set of team members. First off, the greater the size of the team, the more productive the team (Wuchty et al. 2007); hence larger teams ceteris paribus, will transfer more individual specific knowledge along with their relationships. Even after controlling for the effect of the exit of the core human asset and the characteristics of the individuals within the team, the fact that individuals leave together to found a spin-out as opposed to leaving individually should translate into a greater transfer of rival resources. In part, this greater transfer may

result due to factors directly related to the team formation. When starting a new venture, the team leader needs to not only convince other employees to join her, but also to select among them regarding who would be the best for the new venture. Thus, a team implies that the relationships between the members will result in higher value creation than the individual members could create in isolation and a loss of such a team will lead to a higher loss compared with the loss of a set of comparable independent individuals. In addition, a larger team size is indicative of a better selection and matching process based on evidence of rival resources; for instance, employees are more likely to follow team leaders who have more knowledge (Ballinger et al. 2010), which in the legal services context also includes stronger client and complementor relationships. Similarly, team leaders are more likely to pick other members with these characteristics (Dvir et al. 2002, Cogliser and Schriesheim 2000). Moreover, a larger team also represents more comprehensive knowledge breadth since departing teams may be constructed to optimize on linkages within and across specialized skills (Horwitz and Horwitz 2007).

In the context of parent firm performance, consistent with Wezel et al. (2006), we expect that if employees leave as a group as opposed to individually, it translates into a greater negative impact on the parent firm. We expect this to be the case even after controlling for the quality of the team leader and the individual characteristics of the team members[3]. It is more costly for the parent firm to replace the knowledge embodied in a team of employees that works in concert to create value (Phillips 2002) than the same number of employees who do not work as a team. As a result, the greater the level of complementary human assets that leave as a part of a founding team has a greater the disruption to the parent firm.

For spin-outs, we expect that greater transfer of rival resources represented by a larger founding team size will have a stronger positive effect on performance. Critical factors impacting new venture survival are its resource endowments and its perceived legitimacy and reputation. These factors are greater for spin-outs with larger founding team size given the greater transfer of resources and relationships from the parent firm to the spin-out, as noted in research linking the resources embedded in the founding team to spin-out

[3] In Wezel et al., (2006), it is not clear whether the relationship is driven by a higher quality of the founders, or other characteristics that may be different within a team relative to individual entrepreneurs. Our study controls for the quality of the team leader when hypothesizing the relationship between team size and parent performance.

performance (Phillips 2002, Beckman 2006, Delmar and Shane 2006)[4]. Additionally, if parents and spin-outs are competing in the same markets, as the performance of a spin-out improves, the spin-out represents a stronger competitor to the parent which may harm the performance of the parent (Phillips 2002). Thus, increased competition results in an additional mechanism through which the transfer of rival resources adversely affects parent firm performance. Combining the effects on parent and spin-outs yields:

H1: Transfer of rival resources, as measured by the size of the exiting employee team, will (a) negatively impact parent performance and (b) positively impact spin-out performance.

Replication of Non-rival Resources

While the exit of employees to join a spin-out represents the transfer of resources from one firm to another, there may also be a concomitant replication of resources. Indeed, much of the extant work on employee mobility and entrepreneurship highlights employees' ability to imitate organizational knowledge, routines and structures from the parent firm. For example, in describing the entrepreneurial spawning of firms from Fairchild, Gordon Moore ascribes subsequent success of spin-outs such as Intel to the managerial routines that founders learned while at the parent firm and subsequently employed in the new ventures (Moore and Davis 2001). The ability to replicate organizational routines is dependent on the depth and breadth of exposure to the firm specific routines, which is related to the tenure of the employees in the firm.

As in Wezel *et al.* (2006), we assume that the longer the individual team members were employed at the parent, the greater is the knowledge of routines and procedures of the parent firm possessed by the team members. Because routines reflect "experiential wisdom" (Gavetti and Levinthal 2000) and are associated with learning-by-doing (Argote et al. 1990, Becker 2005) as employees accumulate experience in an organization, they acquire knowledge of the routines required by that organization (Zollo and Winter 2002).[5] Since parent firm specific knowledge can be a source of competitive advantage for the spin-out, the greater the tacit knowledge embedded in the firm specific routines, the longer will be the time taken for employees to acquire the requisite managerial skills and organizational capital. However, to the extent that such replication of organizational routines is non-rival, both firms can enjoy access to these resources.

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[4] In the extant literature on spin-out performance and founding team quality, it is again not clear whether the relationship is driven by a higher quality of individual members of the founding team, or other characteristics that may be different within a team relative to individual entrepreneurs.

[5] Our measure is analogous to those used in the corporate strategy literature that proxy for routinization with the length of collaborative experience (e.g. Zollo et al. 2002).

For spin-outs, we hypothesize an unambiguously positive effect of the tenure of the employee team on firm performance. A first order condition for success of a new venture is the establishment of norms, routines and structures within which resources can be appropriately configured. Thus, in addition to the human capital available within the spin-out, the ability to replicate routines, norms and procedures is critical (Phillips 2002, Wezel et al. 2006, Aime et al. 2010), and the managerial skill and the tacit knowledge of how to set-up and run an organization may be particularly useful within the context of the spin-out firm (Mostafa and Klepper 2010). As a result, employee entrepreneurs have the incentive and ability to replicate parent firm organizational routines and procedures (Wezel et al. 2006, Campbell et al. 2010) which changes the competitive landscape of product markets (Aime et al. 2010). Consequently, as with rival assets, the replication of non-rival assets is an important driver of future spin-out performance. We thus anticipate that the replication of non-rival routines and procedures will positively affect spin-out performance.

The mechanism underlying the effect of the replication of organizational routines on parent firm performance is not as clear. On the one hand, Wezel et al. (2006) find that the tenure of employee teams leaving the organization for spin-outs and their ability to replicate parent firm routines results in an adverse performance effect on the parent. On the other hand, Aime et al. (2010) argue that the replication of routines matters only to the extent that they level the competitive landscape between organizations, and that parent organization routines are resilient to the exit of its key members. In particular, Aime et al. (2010) demonstrate that if the parent firm can maintain their organizational routines even after the exit of some of its employees, the replication of organizational routines matters only to the extent that it creates competitive parity with other organizations due to advantageous routines diffusing via employee mobility among the competitors. Overall, these contrasting findings open the question of whether and how the replication of parent firm routines by employee entrepreneurs matters for parent firm performance. However, to the extent that both papers argue for either competitive disadvantage or competitive parity, we expect a negative effect of the tenure of employee team on parent firm performance. The ability to replicate non-rival parent firm routines, norms and procedures within a spin-out organization may increase competitive pressure on the parent organization (Aime et al. 2010) especially if the new organization is competitively "close" to the parent firm and may target the same customers. The greater the tenure of the departing team, the more likely is the extent

to which the spin-out routines and procedures resemble the ones of the parent, and thus the greater the adverse impact on the parent firm. Such an effect occurs in addition to the disruption caused by the transfer of the core and complementary human assets. It is important to note, however, that the adverse impact on the parent firm of the replication of non-rival resources at new ventures is mainly indirect. Hence, we have:

H2: Replication of non-rival resources, as measured by tenure of the exiting employee team will (a) negatively impact parent performance and (b) positively impact spin-out performance.

The Relative Effect of Replication and Transfer of Resources

We now turn to the relative effect of replication and transfer of resources on parent and spin-out performance. For parent firms, while the loss of employees represents a removal of resources that may be costly to replace (Phillips 2002, Wezel et al. 2006), the replication of tacit knowledge and routines within a spin-out may leave parent firms' routines and tacit knowledge virtually intact. Scholars have proposed that routines tend to be tacit, complex and residing in the group and not in a single individual (Kogut and Zander 1992, Nelson and Winter 1982). This suggests that while routines might be temporarily disrupted by employee mobility (Campbell and Saxton 2010) they can be rebuilt at low cost to the source firm. For example, the tacit knowledge that is gained from on-the-job experience of how to best set-up a firm in the industry (Mostafa and Klepper 2010) may be non-rival (Moore and Davis 2001). Thus, while source firms do not directly lose resources when non-rival resources are replicated, they are adversely affected by replication of resources only due to changes in the competitive landscape attributable to increased competitiveness of the recipient organizations (Aime et al. 2010).

In contrast, transferring individuals from parents to spin-outs affects parents through two channels. First, as in the case of the replication of non-rival resources, the parent firms are adversely affected by the indirect effect of altering the competitive landscape by improving the competitiveness of the spinouts. Losing a larger team of valuable employees to a spinout may make it a bigger competitive threat which harms the parent firm. However, in addition to this indirect effect which is similar to the adverse effect of replication non-rival resources, parent firms are adversely impacted through the direct effect of losing key resources. If a valuable and costly to replace team exits a parent to join a spin-out, the parent no longer has access to that team and firm performance is adversely affected. Consequently, both the transfer of rival

resources and the replication of non-rival resources increase the competitive threat of spin-outs which indirectly adversely affects the parent's performance, while the transfer of rival resources has the additional direct effect of losing complementary assets that are costly to replace. As a result:

H3a: Replication of non-rival resources is less detrimental for parent firm performance relative to the transfer of rival resources.

In contrast, we don't believe that such a difference exists for spin-out performance. As new ventures, spin-outs start from a clean slate, and have to create the organizational routines and structures from scratch. Within this nascent context, the shared beliefs and norms represented by the greater familiarity among the founding team members (due to greater team tenure) are critical for the creation of healthy routines. Further, when conflicts arise, team members may use the same referent parent organizational routines for speedier resolution. Thus, the replication of organizational routines in the new venture is equally important to the success of the firm as the quality of the resources that are being transferred. For spin-outs, the value offered by the smooth functioning of the nascent organization, even if it is creating only competitive parity for the parent organization, may be just as high as the value offered by the transfer of resources embodied in the exiting employee team. Thus, we posit:

H3b: The effect of the replication of non-rival resources is not significantly different for spin-out firm performance from the effect of the transfer of rival resources.

Data and Methodology

Context: The U.S. Legal Services Industry

We used data from the legal services industry – a knowledge intensive industry where human assets have a major impact on value creation and appropriation, to test the hypotheses. Professional services play an important and growing role in the U.S. economy. This is due to a shift from manufacturing to services which started in the middle of the last century (Baumol 1967, Fuchs 1968). As a result, the services sector accounts for more than half of the U.S. GDP, while manufacturing accounts for less than a quarter (BEA 2008). In addition, a significant portion of this change is due to the growth in professional services (Buera and Kaboski 2008) which accounts for almost half of the U.S. GDP (BEA 2008).

The transfer and replication of knowledge in professional services is much easier than in manufacturing, since these assets are typically embodied in human assets and the importance of knowledge is high compared to physical assets in the creation of value. As a result human assets are central to value

creation in the legal services industry (Teece 2003). Since employers cannot prevent the movement of human assets, employee mobility and spin-out generation are more likely to occur in professional services than in manufacturing (Teece 2003). Even though one would expect to see the same factors determining both mobility and its impact on the source firm performance in both manufacturing and professional services, they will be more significant in the case of professional services. Finally, there are very few barriers to entry and mobility in this industry because non-compete clauses are not available in this setting and individuals who have the necessary credentials are able to easily move between firms or create new ones.[6] Accordingly, since the legal services sector is one with a mobile employment market and where the rate of new firm entry is high, this provides us with a natural setting to test our theory.

Most law firms are organized around the partnership model; the partners are the principals in the firm and almost all revenues are paid out to the employees, which include partners, as taxable earnings. There are three main groups of employees: staff which includes administrative assistants, secretaries and paralegals; associate lawyers and non-equity partners; and equity partners. Equity partners are typically lawyers who have been promoted after six to ten years of practicing law and receive a share of profits. The division of the firm's profits is typically either equal shares or based on the individual's contribution to the firm's profit (Gilson and Mnookin 1985). The dominance of the partnership models facilitates measurement of parent firm performance using data on employee compensation. In the partnership model, the sum of all compensation paid out by a firm is a close proxy for the revenues collected by the firm.

Data Source

The data are from a custom extract that contains linked employer-employee records drawn from state-level unemployment insurance (UI) records as well as several data products from the U.S. Census Bureau which comprise the Longitudinal Employer-Household Dynamics (LEHD) Project available at the Census Research Data Centers. Employers provide their state with a form ES-202 which lists all active employees covered under the UI program, their taxable earnings, along with the firm's characteristics each quarter. The LEHD project constructs two types of longitudinal records, those that include information for

[6] Because bar exams are state-specific, lawyers' credentials do not necessarily transfer across state borders but are generally transferrable within state borders. In other words, the direct costs of mobility and the direct costs of new firm generation are low within states in this industry.

all employees under the UI program, including employer name and taxable earnings for all employment "spells" (periods), known as *employment history files,* and longitudinal records of all firm-level characteristics, *employer characteristic files*, from these mandatory submissions. In addition, the *individual characteristics files* append demographic information, including race, ethnicity, gender, age, and education. These files are either drawn or imputed from the Social Security Administration's "Personal Characteristics Files," the Decennial Census, the Current Population Survey, and the Survey of Income and Program Participation. By combining these data files, we have detailed information on individual employees and firm level characteristics, along with the relative history of all employee-employer dyads covered by the UI Program.

Our data identify all individuals employed in U.S. legal services over more than 40 quarters in ten large states. Since the data are drawn from mandatory filings, they cover the entire universe of legal services firms in the ten states. This universality permits us to track interfirm employee mobility and to identify new firms. All results have been cleared for disclosure by the U.S. Census Bureau to ensure that no individual respondent or firm could be identified in our presentation.

For empirical tests of our hypotheses, we aggregated employee-level data to the firm level. We excluded very small firms (less than five people) and dying firms (firms that die within the next two years) to eliminate their effects on the measured impact of mobility on firm performance. We also exclude firms with revenues per employee of less than $10,000 or more than $1,000,000 and firms that lost or gained more than 500 employees in any payroll class to an established firm or to a spin-out in a given year. This last restriction allowed us to exclude mergers, acquisitions, and administrative recoding of organizational identifiers.[7]

Estimation Methodology

Our analytic strategy was to first construct proxies for the different types of assets that mobile entrepreneurs take with them to their new firms and then examine how the transfer/replication of these assets through employee entrepreneurship affects the performance of parent firms and spin-out firms. Specifically, we constructed measures of the resources with the different degrees of rivalness embedded in departing teams, then estimated a series of fixed-effects linear regression equations of parent firm revenue per

[7] An administrative recode is when the data collection agency changes a firm's identification number. Administrative recodes appear in the data to be large mobility events where *all* of a firm's employees move from an existing firm to a new firm. Inclusion of these events would contaminate our measures of mobility to spin-outs.

worker as a function of the intensity of the different assets of employee entrepreneurs and a series of cloglog equations where spin-out survival is a function of the intensity of the different assets of the employee entrepreneurs. Our explanatory variables included size of the departing team, experience of the departing team and earnings of the departing team leader. We included firm fixed effects to absorb any variation caused by unobserved firm-constant characteristics. In each firm performance specification, we estimate the effect of employee entrepreneurship while controlling for the general exit.

Variables

Parent Firm performance: Since partners typically divide up the firm's profits and receive this as taxable income, we measure parent firm performance by examining the sum of taxable income paid to the firm's employees. This gave us a measure of firm's total revenues (less non-compensation costs and set-asides for future years). Consistent with prior work (Campbell et al. 2010), in order to adjust for firm size, we used the firm's average total revenues, which is the firm's revenue per employee. This allows us to compare the productivity of firms of different sizes. In order to determine the impact of employee mobility on firm performance, firm performance is measured one year after the mobility event, which allows us to account for the earnings of replacement employees as well as those who were retained. As a result, the measured impact of mobility on performance is conservative.

Spinout firm performance: Because new ventures may invest a large share of their revenues in building future business opportunities, and because the share of their revenues that start-ups invest in this activity may vary greatly across firms, revenues are a very noisy measure of spin-out performance. To measure spin-out performance, we focused on survival. Because failure rates for new firms are high, survival may more accurately capture the primary objective of the organization. For every spin-out, we construct a survival variable that takes the value of 0 if they do not exit the data in the next year and 1 if they do.

Team Size of Employees Leaving for Spin-out. To capture the extent of rival resources moving with the team we counted all individuals that move with from the parent firm to the focal spin-out in the same calendar year. After controlling for the education, age, gender of the team members, total number of exits, and earnings of the highest paid member of the team, the size of the team captures the effect of individuals moving as a team relative to the effect of those same individuals moving independently. We

control for the quantity and quality of individuals leaving the parent firm, so this measure captures the loss of rival resources above and beyond those embedded in isolated individuals. This measure is used in Model 1 of the regressions reported below. We also develop an alternative standardized team size measure, used in Model 2 of the regressions by subtracting the sample mean from each record and dividing by the sample standard deviation. For parent firms that experience multiple spin-out events in a particular year, we averaged the team size across the different spin-outs for that year.

Average Tenure of Employees Leaving for Spin-outs. While the above measure captures the transfer of more rival resources, we follow extant literature (e.g. Wezel et al. 2006) and proxy for the replication of less rival resources like routines and procedures embedded in a team departing for spin-outs based on the number of years the departing team was at the parent firm. We calculated the measure as the average tenure at the parent firm for the departing team members to the focal spin-out. We developed a standardized measure of average tenure (for Model 2 regressions) also by subtracting the sample mean and dividing by the sample standard deviation. As above, if a parent experienced more than one spin-out in any one year, we computed the simple average of this measure across all spin-out events for that year.

In our robustness tests, we tested alternative measures of departing team tenure. We calculated the minimum tenure of departing teams and the maximum tenure of the departing teams. The minimum tenure (or joint tenure) calculation captures the number of years that all team members were concurrently employed at the parent firm. The maximum tenure measure captures the longest time period that any team member was employed at the parent firm and serves as an upper bound on the tenure of the team. To capture the possibility that workers with short tenure did not have sufficient time to learn about the parent firm routines and processes, we calculated additional tenure measures by including only workers with more than one and two years of tenure. Due to the sample time frame, a small portion of the tenure measures are censored. To test the robustness of our results, we calculated multiple additional measures of tenure assuming that workers with censored tenure have on average an additional 1, 5, 10 or 20 years of work experience with the parent firm.

Control variables. In our firm performance estimations, we included a firm fixed effect, several time-variant firm-level controls, and several local labor market controls, controls for the quality of the team

leader and we also controlled for the means of the observed demographic and human asset variables measured over all of a firm's employees and across all employees that leave the firm. Specifically, we included controls for firm age, firm size (calculated as employment in the fourth quarter of each year) and a lagged dependent variable. Our measure of the quality of the team leader is the earnings of the team leader. We identified the team leader as the member that had the highest earnings among individuals in the departing team, and thus appropriated the greatest value from their employer in the previous year. This measure is based on the assumption that earnings are positively related to an individual's position in the hierarchy of the firm (e.g. Levine 1993, O'Reilley et al. 1988) and that the team member with the greatest earnings most likely captures the team member with the most authority and most responsibility at the previous employer. The quality of the team leader reflects a combination of rival and non-rival resources. The team leader can only be employed by one firm so knowledge that is specific to this employee is rival, however the quality of the leader is also correlated with the extent of routines that can be replicated: a higher quality team leader may have access to a broader swath of routines than a lower quality team leader. Since we cannot separate the rival and non-rival components of knowledge embedded in the team leader, we treat this variable as a control and focus our hypothesis testing on the cleaner measures of rival and non-rival knowledge. As with the previous measures, for parent firms that experienced more than one spin-out event in a year, we computed an average of the earnings of the team leaders across these events.

At the local market level, we controlled for the number of other firms in the Metropolitan Statistical Area (MSA) and also the revenue variation across firms in the local MSA. To capture the effect of the stock of human assets on firm performance we added controls for employee demographic characteristics such as mean age, racial and gender composition of the firm and mean education in the last quarter of each year. Firm with high turnover will tend to produce over-counting of employees, resulting in biased year averages. In order to minimize this possibility, we used only a single quarter. We also included controls for the characteristics of the employees that left the firm in the prior year. Specifically we included controls for the number of employees that left the firm, the number of employees that left the firm to join a spin-out, as well as the education, age, and gender of employees that left for all firms and for spin-out firms. Importantly, we also control for the effect of general exit, i.e. the effect of all exiting employees, regardless of whether they

joined a spin-out or an existing firm after leaving the parent firm. To do so, we included counterparts of the explanatory variables measured for all exiting employees — team size, average tenure and earnings for all exiting employees.

Tables 1 and 2 give descriptive statistics and correlations of the parent firm data and Tables 3 and 4 provide summary statistics and correlations of the spin-out sample.

Results

Table 5 contains our results on the effect of employee entrepreneurship on parent firm performance. Model 1 in Table 5 provides baselines estimates. We include the unstandardized and standardized measures of the team size and average tenure in Models 1 and 2 respectively. The estimates of the control variables presented in Model 1 indicate the gender distribution of leavers to spin-outs affects parent firm performance, however the total number, age and education levels of leavers to spin-outs does not have a significant impact on parent firm performance.

Models 1 and 2 demonstrate that the average earnings of team leaders of teams that join spin-outs have an adverse impact on parent firm performance. The finding that losing core human assets to spin-outs adversely affects parent performance is consistent with prior findings in the literature (Campbell et al. 2010). A one standard deviation increase in the average earnings of spin-out team leaders has an adverse impact on revenue per worker at the parent firm of $1,108. In other words, at an average firm of 84 people, a one standard deviation increase in the earnings of the departing leaders joining spin-outs has an adverse impact of $92,881. This is a dramatic effect considering that leaders include solo movers who may be disproportionately low quality employees who were unable to convince colleagues to move with them. As a result, this estimate is a conservative estimate of the impact of core human capital on parent firm performance.

Turning to our hypothesized relationships, the models demonstrate that the employee team size has an adverse impact on parent firm performance even after controlling for the observable human capital of the leaving team (as captured by the total number of employees leaving and their characteristics). This finding suggests that even after controlling for the loss of human capital of each team member, the adverse impact on parent firm performance increases with team size which supports H1a. A one standard deviation increase in

team size of spin-out leavers has an adverse impact on parent revenue per worker of $1,320 which translates to an impact of $110,644 at an average sized firm. In contrast, we do not find support for H2a. The effect of tenure of team members that depart for spin-outs is not significant in both Model 1 and 2. In Model 2, comparing the magnitude of the effect on parent firm performance of the standardized team size of leavers to spin-outs and standardized average tenure of leavers to spin-outs indicates that the two standardized coefficients are statistically different at 5% level.[8] This finding thus supports H3a.

For spinout performance, we present the results of cloglog regressions in Table 6, with survival as the dependent variable. In addition to our main variables of interest (team size and average team work experience at the parent), we employ a standard set of control variables including team leader earnings, spin-out age, spin-out size and size at entry, age and size of the parent firm, demographics of the spin-out team (age, education, and gender) and regional characteristics like the firm density in the MSA. We note that the earnings of the team leader are a significant predictor of spin-out performance only when the variables controlling for the team size and experience are not present in the regressions. We find strong support for both H1b and H2b. We find that the size of the spin-out team size is positively related to spin-out survival (H1b) and the gain of employee experience positively affects spin-out firm survival (H2b). Further, the standardized variables (Table 6, Model 2) show that one standard deviation of work experience has a statistically indistinguishable effect on spin-out firm survival relative to the same change in the founding team size, thus supporting H3b. Importantly, it shows that both transfer of resources (team size) and replication of routines (experience at the parent firm) are significant drivers of spin-out performance, and not statistically distinguishable from each other.

Additional Analysis and Robustness Checks

We find strong support for our predication that the transfer of more rival resources to spin-outs has an adverse affect on parent firm performance and that the magnitude of the adverse affect is greater than the effect of the replication of less rival resources. However, given the non-finding for H2b, we want to ensure that this result is consistent across alternative measures for the replication of routines and procedures. To

[8] Because the team size and tenure variables are of different magnitudes, it is not appropriate to compare the size of their coefficients without standardizing the variables.

refine our analysis we explore different specifications of our measure of the replication of the less rival resources to spin-outs. In the previous analyses, we used the team members' average tenure at the parent firm as an empirical proxy. However, the relevant construct may be how long the team members have worked together. Alternatively, if knowledge of routines and procedures is easily transferrable across team members, then the relevant construct should be the maximum level of routine knowledge in the team membership. We address these two alternative specifications by examining the minimum and maximum tenure of team members leaving the parent firm. The minimum tenure of the team captures the joint experience of all of the team members at the parent firm and the maximum tenure captures the upper bound of the knowledge and routines embedded in the departing team. Second, one could argue that employees with short tenure did not have sufficient time to acquire necessary routines and inclusion of these employees in the calculation is adding noise which, in turn, leads to insignificant results. To address this issue we only include in the tenure measure calculation the employees who have at least 1 or 2 years of tenure with the parent firm. Third, a portion of employees have a censored measure of tenure due to the time frame of the sample. It may be possible that the insignificant effect of tenure is driven by such censoring. To investigate the sensitivity of our results to censoring we assume that censored employees have 1, 5, 10 and 20 additional years of tenure with the parent firm.

In Table 7, we present the results from these alternative unstandardized specifications. Model 1 includes minimum team tenure as the key explanatory variable, and Model 2 includes maximum team tenure. Models 3 and 4 utilize the tenure variable based only on employees at least with 1 and 2 years of tenure, respectively. Models 5-8 use the tenure measures that assume that censored tenure measurements have on average an additional 1, 5, 10 or 20 years of tenure, respectively. Because revenue growth might be a better measure of firm performance than revenue level, we also tested whether all results are robust when using the dependent variable of growth in payroll per worker. The previous findings are robust to all alternative specifications: the transfer of more rival resources has an adverse impact on parent firm performance, but the transfer of less rival resources does not have a measurable effect on parent performance.

In Table 8, we present the analogous alternative unstandardized specifications in the estimates of spin-out survival. Again, our findings are robust to the alternative measures of non-rival resources. In all

alternative specifications we find that both the spin-out team size and employee experience have a positive effect on spin-out survival.

In addition to the above robustness checks, we examined the endogeneity of the employee exit decision. It is possible that employees leave to create spin-outs due to the existing decline in revenues (as opposed to our theorized relationship proposing that employee exit causes the decline in revenues). In all of our specifications, we already excluded failing firms (firms that exit in the next two years) and included lagged revenue per worker control. To further rule out this alternative explanation, we created subsamples of firms that experienced only growth in revenues either in the focal year, year *t*-1 or *t*-2 and found virtually identical results. Also, in unreported results, we tested whether our results are driven by the number and work experience of only lower earning members of the founding spin-out team (staff and administrators), rather than higher level knowledge possessed by higher paid attorneys, and found this not to be the case.

Discussion and Conclusion

The rich literature on the parent and spin-out competitive dynamics has documented that transfer and replication of resources through employee entrepreneurship can have significant effects on both firms' performance (Agarwal et al. 2004, Aime et al. 2010, Campbell et al. 2010, Franco and Filson 2006, Klepper and Sleeper 2005, Phillips 2002, Somaya et al. 2007, Wezel et al. 2006). However, most of this work has studied the effects of employee entrepreneurship by examining the effect of work experience, founding team size or the quality of the team leader separately, rather than jointly, and for either the parent or spin-out firm. Our study examines whether there is a differential impact of the transfer of rival resources, relative to the replication of less rival resources on parent and spin-out firm performance. We hypothesize that the transfer of more rival knowledge should have a greater adverse effect on parents relative to the replication of routines and other less rival knowledge, but that both the transfer and replication of knowledge helps spin-outs equally. We test our hypotheses in the context of the legal services industry—a professional services context where employee mobility is critical to knowledge transfer and replication.

Our results show that resources that are embodied in exiting employee entrepreneurs impact the parent firm to different degrees. We disentangle the effect of work experience from the "pure" team effect (leaving together as opposed to individually), from the quality of the core asset (earnings of the team leader)

and from observable team and parent firm characteristics. Joint examination of the studied variables produces unique insights regarding the performance of spin-outs and their parent firms. Importantly, the study highlights the difference between knowledge transfer and knowledge replication, terms which have been used interchangeably in the literature, by emphasizing their differing degrees of rivalness.

The transfer of rival resources, measured by the number of members in a departing future founding team, has both a significant negative effect on the parent firm and a significant and positive effect on the spin-out. The employees may be voting with their feet: spin-outs with higher opportunities or advantages relative to the parent firm attract more individuals from the founder's former employer. The size of the team reflects not only the additive influence of individuals leaving *en masse*, but also the effect of selection and synergies in the team composition: larger teams imply that these employees are walking out with better configured resources, coupled with other factors (such as larger transfer of client and supplier relationships). Such teams result in a greater transfer of rival resources that simultaneously hurt the parent firm and benefit the spin-out.

In contrast, we find that after controlling for the quality of the core human asset (the earnings of the team leader) and the transfer of rival resources (team size), a founding team with longer work experience at the parent firm *does not lead* to a significantly different impact on the parent firm relative to one with the shorter work experience. We note that our result is in contrast with Wezel et al. (2006), who found that team experience hurts parent firm performance, but the difference may be due to the inclusion of control variables such as characteristics of the team and its leader, and measuring the effect after the parent firm has the opportunity to replace and replenish the employees who left in the parent firm in our analysis. They are, though, consistent with Aime et al. (2010) findings regarding general mobility; our study shows that for the special case of employee entrepreneurship, the replication of routines is not harmful to the parent firms. However, on the spin-out side, the replication of routines by more team members has a significant beneficial impact, and is as important as the transfer of the more rival resources, even after including controls. This result confirms the notion that the prior work experience plays an important role when setting up a new organization and that parent firm specific knowledge has value for the spin-out. The asymmetric effect of resources that are less rival—lack of significant performance consequences for parents and positive benefits

for spin-outs—suggests that replication can lead to a Pareto-improvement within the industry. Importantly, routines and procedures which are considered important repositories of knowledge (March 1991, Nelson and Winter 1982, Becker 2005) are less effective as protective mechanisms since replication is possible, but these replications nonetheless do not significantly impact parent firm performance.

Taken together, our comparison of the differential effects of resources that are more rival compared to those that are less rival reveals an important finding: while the transfer of rival resources are much more salient for parent firm performance than the replication of non-rival resources, from the spin-out perspective, both matter equally. Thus, it highlights the asymmetry of factors that operate in *resource* markets rather than *product* markets, which may have competitive advantage rather than competitive parity consequences for parent and spin-out firm performance. Prior research suggests that the replication of routines through employee mobility is the basis for product market competition between rivals (Aime et al. 2010, Wezel et al. 2006). Under this assumption, from a parent firm's perspective, the adverse performance effects seem to originate more from factors operating in the resource markets, rather than solely in the product markets. In other words, the loss of human capital resources to rivals affects parent firms more adversely than rivals' enhanced capability to replicate product-based routines. However, from the spin-out firm perspective, the ability to compete away critical assets from the parent firm in the resource market, *and* the ability to replicate firm specific routines for better configuration of capabilities in the product market are both equally beneficial to performance.

Our research has a number of limitations, several of which may be fruitful avenues for future work. First, our results are based on a single industry. While that there are a number of other industries that are similar to this one, such as advertising, accounting and consulting, the legal services industry has a number of features that are atypical of other industries such as manufacturing. Our results may not extend to manufacturing because of the higher cost of starting up a firm, and the complementary assets are more likely to be embodied in the production process itself. Second, we do not measure direct competitive interactions between the parent and the spin-out. In particular, since we do not have access to the specialties of the team members, or other measures of the actual knowledge possessed by team members, we cannot compare the spin-out's set of specialties or knowledge base with that of the parent firm. This could lead to a moderating

effect on both the parent and spin-out firms' performance. Third, our proxies for rival and non-rival resources are imperfect; we capture non-core, rival resources by focusing on founding team size and we capture non-rival resources with various measures of founding team experience. However, there may be other rival and non-rival resources which are transferred and replicated between parents and spin-outs that are not captured in these measures. As a result, our proxies may underestimate the impact of rival and non-rival resources and our estimates are conservative tests of our hypotheses. Another concern is that the employees we classify as leaving incumbents voluntarily to form spin-outs may represent involuntary mobility since the focal employees are instead terminated by their employers. If this concern is valid and individuals found new firms as their employment option of last resort, then the adverse effect on parent firm performance of losing the employees and experiences embodied in these employees understates the impact of employee entrepreneurship and our estimates are conservative tests of our hypotheses.

In addressing our questions, we contribute to the literatures on organizational routines and strategic entrepreneurship. Building on earlier work, our paper examines simultaneously, rather than in isolation, the effect on parent and spin-out performance due to the transfer or replication of resources. In doing so, we extend the organizational routines literature by showing that routines which represent critical repositories of firm-specific knowledge (March 1991; Nelson and Winter 1982) may support competitive advantage relative to other rivals, but these advantages may be threatened by spin-outs which represent a blank slate for routines to be easily replicated by exiting employees. However, the replication of organizational routines does not result in significant adverse performance effects on the parent since they still retain their own repositories of this firm specific knowledge, in contrast to the negative consequences of the loss of rival (human) resources.

Our research also adds to strategic entrepreneurship by examining the effects of resource transfer and replication through employee entrepreneurship. We answer Agarwal et al. (2010)'s call for research disentangling the effects of knowledge transfer from knowledge spillover. Our study also sheds light on the underlying factors that lead spin-outs to initiate creative destruction (Schumpeter, 1934) on their parent firms. Our research shows that the destruction of parent firm value wrought by the creation of spin-outs is through the transfer of rival assets, not through the replication of non-rival assets. It also adds to our understanding of the differential role of factors operating in both resource and product markets—the creation of a spin-out

results in increased competition in resource markets which hurt parent firms more than a competitor being added in the product market through the replication of routines and procedures. From a new venture's perspective, the issue of rivalness of resources is far less salient; when creating a new organization, the development of routines by replicating the parent firm's specific knowledge is just as important as the transfer of human assets.

This work also has important implications for managers. Because employees can quit "at will" to pursue more desirable opportunities (Coff 1997) such as founding a new venture (Carnahan et al. 2010), human capital is both highly mobile and rivalrous in nature. On the other hand, organizational routines and procedures are non-rivalrous. These distinctions are important for managers' development of human resource structures and investment decisions. Our work suggests that since the impact of knowledge transfer on the parent firm is higher than that of knowledge replication. Thus, managers at existing organizations should focus on investing in developing organizational structures, such as compensation plans, that minimize the likelihood of employee entrepreneurship regardless of the number of years the employee has been at the organization. They should also work systematically to identify factors that increase stickiness of team members not just to each other, but to the entire firm. Since team mobility to spin-outs is likely and their performance effects are large (Campbell et al. 2010), managers need to focus on factors that increase loyalty and connection with the firm at large, rather than within immediate teams and work groups. For founders of new firms, our work suggests that the survival of the new venture is aided by both transfer and replication of resources, and that they need to pay equal attention to both mechanisms. When selecting potential team members for the new venture, they should equally emphasize the creation of smooth and successful routines by factoring in the importance of experience of team members *with* each other, along with what each team member brings to the table individually.

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TABLE 1
Summary Statistics for Parent Firm Sample

	Variable	Obs.	Mean	Std. Dev.
1	Revenue/employee	11822	67.85	45.15
2	Revenue/employee, (t-1)	11822	74.09	227.90
3	Team size, all departing employees	11822	1.31	1.02
4	Team size, employees departing for spin-outs	11822	1.50	1.69
5	Avg. tenure, all departing employees	11822	1.66	1.42
6	Avg. tenure, employees departing for spin-outs	11822	1.79	1.89
7	Standardized team size, all departing employees	11822	0.04	1.11
8	Standardized team size, employees departing for spin-outs	11822	0.03	1.08
9	Standardized tenure, all departing employees	11822	0.05	1.02
10	Standardized tenure, employees departing for spin-outs	11822	0.04	1.00
11	Earnings, team leader, all departing employees	11822	41471	46213
12	Earnings, team leader, employees departing to spin-outs	11822	50632	77517
13	# of employees leaving	11822	9.12	26.30
14	# of employees departing to spin-outs	11822	1.96	2.87
15	Avg. age, all departing employees	11822	34.96	6.79
16	Avg. age, employees departing for spin-outs	11822	35.35	9.06
17	% males, all departing employees	11822	0.27	0.28
18	% males, all employees departing for spin-outs	11822	0.29	0.41
19	Avg. education, all departing employees	11822	14.20	1.65
20	Avg. education, all employees departing for spin-outs	11822	14.31	2.30
21	# employees	11822	83.79	286.13
22	# firms in MSA	11822	1739	1610
23	(# firms in MSA)^2 /1000	11822	5617	9134
24	Revenue variance	11822	12497	152693
25	Firm age	11822	4.67	2.79
26	Avg. age, all employees	11822	36.99	4.55
27	Avg. education, all employees	11822	14.25	0.87
28	Avg. tenure, all employees	11822	2.08	1.25
29	% male, all employees	11822	0.32	0.14
30	% white, all employees	11822	0.84	0.17

TABLE 2
Correlations for Parent Firm Sample

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1Revenue/employee	1.00																												
2Revenue/employee, (t-1)	0.15	1.00																											
3Team size, all departing employees	-0.01	-0.01	1.00																										
4Team size, employees departing for spin-outs	0.03	0.00	0.57	1.00																									
5Avg. tenure, all departing employees	0.03	0.00	0.07	0.10	1.00																								
6Avg. tenure, employees departing for spin-outs	0.05	0.01	0.05	0.09	0.78	1.00																							
7Standardized team size, all departing employees	-0.01	-0.01	1.00	0.57	0.07	0.05	1.00																						
8Standardized team size, employees departing for spin-outs	0.03	0.00	0.57	1.00	0.10	0.09	0.57	1.00																					
9Standardized tenure, all departing employees	0.03	0.00	0.07	0.10	1.00	0.78	0.07	0.10	1.00																				
10Standardized tenure, employees departing for spin-outs	0.05	0.01	0.05	0.09	0.78	1.00	0.05	0.09	0.78	1.00																			
11Earnings, team leader, all departing employees	0.33	0.06	0.20	0.19	0.20	0.17	0.20	0.19	0.20	0.17	1.00																		
12Earnings, team leader, employees departing to spin-outs	0.32	0.06	0.17	0.28	0.15	0.20	0.17	0.28	0.15	0.20	0.82	1.00																	
13# of employees leaving	0.01	0.01	0.53	-0.18	0.03	-0.01	0.53	0.18	-0.03	-0.01	0.05	0.04	1.00																
14# of employees departing to spin-outs	0.04	0.00	0.47	0.79	0.07	0.08	0.47	0.79	0.07	0.08	0.17	0.24	0.34	1.00															
15Avg. age, all departing employees	0.04	0.01	0.07	0.05	0.25	0.19	0.07	0.05	0.25	0.19	0.17	0.12	0.00	0.04	1.00														
16Avg. age, employees departing for spin-outs	0.04	0.02	0.05	0.04	0.20	0.26	0.05	0.04	0.20	0.26	0.14	0.15	0.01	0.04	0.73	1.00													
17% males, all departing employees	0.09	0.02	0.10	0.05	0.05	0.05	0.10	0.05	0.05	0.05	0.21	0.17	0.11	0.06	-0.07	-0.02	1.00												
18% males, all employees departing for spin-outs	0.08	0.01	0.05	0.03	0.03	0.07	0.05	0.03	0.03	0.07	0.16	0.22	0.06	0.04	-0.03	-0.03	0.70	1.00											
19Avg. education, all departing employees	0.09	0.03	-0.04	0.02	0.10	0.07	-0.04	0.02	0.10	0.07	0.15	0.11	-0.04	0.02	0.21	0.15	-0.01	0.01	1.00										
20Avg. education, all employees departing for spin-outs	0.08	0.02	-0.02	0.01	0.08	0.14	-0.02	0.01	0.08	0.14	0.12	0.15	-0.01	0.02	0.16	0.22	0.01	0.03	0.72	1.00									
21# employees	-0.02	0.01	0.30	-0.07	0.03	-0.02	0.30	0.07	-0.03	-0.02	0.01	0.00	0.70	0.20	-0.02	-0.01	0.10	0.04	-0.05	-0.03	1.00								
22# firms in MSA	0.17	0.03	-0.03	0.01	0.00	0.02	-0.03	0.01	0.00	0.02	0.08	0.07	-0.01	0.00	-0.09	-0.06	0.12	0.11	0.03	0.02	-0.04	1.00							
23(# firms in MSA)^2	0.14	0.02	-0.02	0.02	0.02	0.03	-0.02	0.02	0.02	0.03	0.07	0.06	-0.01	0.00	-0.09	-0.06	0.12	0.10	0.02	0.01	-0.03	0.95	1.00						
24Revenue variance	0.54	0.07	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.11	0.14	0.00	0.01	-0.01	0.00	0.02	0.02	0.00	0.01	-0.01	0.04	0.03	1.00					
25Firm age	0.05	0.00	0.03	0.05	0.42	0.36	0.03	0.05	0.42	0.36	0.05	0.04	0.03	0.03	0.07	0.05	0.03	0.02	-0.17	-0.12	0.04	0.14	0.17	0.00	1.00				
26Avg. age, all employees	0.08	0.02	0.01	0.00	0.24	0.19	-0.01	0.00	0.24	0.19	0.09	0.05	-0.04	-0.01	0.50	0.36	-0.07	-0.04	0.10	0.07	-0.03	-0.15	-0.15	0.00	0.15	1.00			
27Avg. education, all employees	0.24	0.06	-0.10	-0.01	0.04	0.03	-0.10	0.01	0.04	0.03	0.13	0.11	-0.07	0.01	0.12	0.09	-0.02	0.00	0.51	0.37	-0.08	0.07	0.04	0.02	-0.23	0.26	1.00		
28Avg. tenure, all employees	0.10	0.01	-0.01	0.04	0.62	0.51	-0.01	0.04	0.62	0.51	0.11	0.08	-0.04	0.03	0.15	0.12	0.01	0.01	-0.04	-0.02	-0.03	0.08	0.11	0.00	0.75	0.38	0.06	1.00	
29% male, all employees	0.24	0.06	0.13	-0.04	0.01	0.00	0.13	0.04	-0.01	0.00	0.10	0.10	0.15	0.06	-0.04	-0.01	0.44	0.32	0.01	0.01	0.15	0.16	0.15	0.04	0.01	0.00	0.04	0.03	1.00
30% white, all employees	0.02	0.01	-0.05	-0.01	0.11	0.09	-0.05	0.01	0.11	0.09	0.02	0.02	-0.12	-0.04	0.14	0.12	-0.05	-0.04	0.08	0.06	-0.12	-0.22	-0.18	-0.01	-0.01	0.28	0.18	0.14	-0.03

TABLE 3
Summary Statistics for Spin-out Sample

	Variable	Obs	Mean	Std. Dev.
1	Spin-out fails in (t+1)	42624	0.07	0.25
2	Spin-out size at entry	42624	6.31	63.10
3	Size of spin-out team	42624	1.66	1.99
4	Standardized spin-out team size	42624	0.12	1.44
5	Avg tenure of spin-out team	42624	1.54	1.72
6	Standardized spin-out team tenure	42624	0.05	1.06
7	Earnings of team leader	42624	62089	92597
8	Avg employment of parent firm(s)	42624	352.9	4456.5
9	Age of parent firm at spin-out birth	42624	2.96	2.44
10	Dummy: Age of parent firm is censored	42624	0.19	0.39
11	Avg age of spin-out team	42624	36.12	8.94
12	Avg education of spin-out team	42624	14.87	2.22
13	% male in spin-out team	42624	0.30	0.42
14	Spin-out # employees	42624	12.71	66.59
15	Spin-out age	42624	3.80	2.56
16	Spin-out age^2	42624	21.02	26.65
17	# firms in MSA	42624	2887.90	3551.11
18	# firms in MSA^2 /1000	42624	21000.00	49200.00

TABLE 4
Correlations for Spin-out Sample

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1Spin-out fails in (t+1)	1																
2Spin-out size at entry	-0.01	1.00															
3Size of spin-out team	-0.03	-0.01	1.00														
4Standardized spin-out team size	-0.03	-0.01	1.00	1.00													
5Avg tenure of spin-out team	-0.03	-0.01	0.05	0.05	1.00												
6Standardized spin-out team tenure	-0.03	-0.01	0.05	0.05	1.00	1.00											
7Earnings of team leader	-0.03	0.00	0.26	0.26	0.14	0.14	1.00										
8Avg employment of parent firm(s)	0.00	0.01	0.01	0.01	-0.03	-0.03	-0.01	1.00									
9Age of parent firm at spin-out birth	-0.02	0.00	0.03	0.03	0.58	0.58	0.02	-0.02	1.00								
10Dummy: Age of parent firm is censored	0.00	0.01	0.08	0.08	0.07	0.07	-0.03	-0.03	0.07	1.00							
11Avg age of spin-out team	-0.01	-0.02	0.01	0.01	0.19	0.19	0.13	0.02	0.04	-0.03	1.00						
12Avg education of spin-out team	-0.02	0.04	0.01	0.01	0.07	0.07	0.14	-0.02	-0.10	-0.01	0.11	1.00					
13% male in spin-out team	-0.02	0.01	0.03	0.03	0.10	0.10	0.29	0.02	0.04	-0.07	0.03	0.12	1.00				
14Spin-out # employees	-0.02	0.68	0.04	0.04	-0.02	-0.02	0.00	0.02	-0.02	0.03	-0.03	0.05	0.04	1.00			
15Spin-out age	-0.06	0.03	0.02	0.02	-0.13	-0.13	0.01	-0.04	-0.28	0.11	-0.04	0.07	0.01	0.06	1.00		
16Spin-out age^2	-0.06	0.03	0.02	0.02	-0.14	-0.14	0.01	-0.04	-0.27	0.11	-0.04	0.07	0.01	0.05	0.96	1.00	
17# firms in MSA	-0.10	-0.02	0.01	0.01	0.07	0.07	0.06	0.06	0.16	-0.15	0.01	-0.02	0.08	-0.03	0.18	0.19	1.00
18# firms in MSA^2	-0.09	-0.01	0.00	0.00	0.06	0.06	0.04	0.07	0.14	-0.14	0.03	-0.03	0.06	-0.02	0.15	0.16	0.95

TABLE 5
Parent Performance Regressions

	Model 1			Model 2 (Standardized)		
Explanatory variables:						
Team size, employees departing for spin-outs	-0.783	(0.393)	**	-1.320	(0.663)	**
Avg. tenure, employees departing for spin-outs	0.282	(0.279)		0.532	(0.527)	
Controls, characteristics of employees departing for spin-outs:						
Earnings, team leader, employees departing for spin-outs x1000	-0.014	(0.009)	*	-0.014	(0.009)	*
# of employees departing to spin-outs	-0.080	(0.193)		-0.080	(0.193)	
Avg. age, employees departing for spin-outs	0.079	(0.057)		0.079	(0.057)	
% males, employees departing for spin-outs	2.859	(1.156)	**	2.859	(1.156)	**
Avg. education, employees departing for spin-outs	-0.121	(0.217)		-0.121	(0.217)	
Controls, characteristics of all exiting employees:						
Earnings, team leader, all exit x1000	0.149	(0.016)	***	0.149	(0.016)	***
Avg. team size, all exit	1.343	(0.715)	*	1.365	(0.727)	*
Avg. tenure, all exit	-0.742	(0.486)		-1.052	(0.690)	
# of employees leaving	0.072	(0.032)	**	0.072	(0.032)	**
Avg. age, all exit	-0.174	(0.099)	*	-0.174	(0.099)	*
% males, all exit	-9.574	(2.087)	***	-9.574	(2.087)	***
Avg. education, all exit	-0.245	(0.386)		-0.245	(0.386)	
Firm level controls:						
Revenue/worker, (t-1)	-0.002	(0.001)	*	-0.002	(0.001)	*
# employees	-0.030	(0.004)	***	-0.030	(0.004)	***
Revenue variance x1000	0.124	(0.003)	***	0.124	(0.003)	***
Firm age	1.681	(0.467)	***	1.681	(0.467)	***
Avg. age, all employees	0.052	(0.239)		0.052	(0.239)	
Avg. education, all employees	1.832	(1.154)		1.832	(1.154)	
Avg. tenure, all employees	-2.205	(0.903)	**	-2.205	(0.903)	**
% male, all employees	29.298	(6.873)	***	29.298	(6.873)	***
% white, all employees	5.051	(7.244)		5.051	(7.244)	
# firms in MSA	-0.014	(0.004)	***	-0.014	(0.004)	***
(# firms in MSA)^2 x1000	0.002	(0.001)	***	0.002	(0.001)	***
Constant	27.737	(17.309)		27.623	(17.340)	
N Observations	11822			11822		
R-squared	0.2797			0.2797		

Note: Models include firm and year fixed effects. Models use robust standard errors.
*** Significant at the 1% level ** Significant at the 5% level * Significant at the 10% level

TABLE 6
Spin-out Survival Regressions

	DV = 1 if spin-out fails in the following year					
	Model 1			Model 2 (Standardized)		
Explanatory variables:						
Size of spin-out team	-0.063	(0.015)	***	-0.087	(0.021)	***
Avg. tenure of spin-out team	-0.051	(0.015)	***	-0.082	(0.024)	***
Controls, characteristics of spin-out team:						
Earnings of team leader x10000	-0.001	(0.003)		-0.001	(0.003)	
Avg. age of spin-out team	-0.005	(0.002)	**	-0.005	(0.002)	**
Avg. education of spin-out team	-0.005	(0.009)		-0.005	(0.009)	
% male in spin-out team	-0.029	(0.049)		-0.029	(0.049)	
Avg. employment of parent firm(s) x1000						
Age of parent firm at spin-out birth	-0.001	(0.002)		-0.001	(0.002)	
Dummy: Age of parent firm is censored	0.001	(0.004)		0.001	(0.004)	
Controls, spin-out characteristics:	-0.049	(0.012)	***	-0.049	(0.012)	***
Spin-out # employees	-0.006	(0.001)	***	-0.006	(0.001)	***
Spin-out age	-0.152	(0.029)	***	-0.152	(0.029)	***
Spin-out age^2	0.005	(0.003)		0.005	(0.003)	
# firms in MSA x1000	-0.037	(0.044)		-0.037	(0.044)	
# firms in MSA^2 x100000	0.010	(0.008)		0.010	(0.008)	
Constant	-21.541	(718.690)		-21.710	(718.694)	
N Observations	42,624			42,624		
Log-likelihood	-9239.56			-9239.56		
LR chi2(28)	2307.67			2307.67		

Note: Models control for year fixed effects relative to 2004.
*** Significant at the 1% level ** Significant at the 5% level * Significant at the 10% level

TABLE 7

Parent Performance Regressions with Alternate Measures of Team Tenure

DV = Revenue/Worker	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Tenure Measure	Min.	Max.	>1 yr. Tenure	>2yr. Tenure	Cens. +1 year	Cens. +5 years	Cens. +10 years	Cens. +20 years
Explanatory variables:								
Team size, employees departing for spin-outs	-0.780 **	-0.788 **	-0.787 **	-0.789 **	-0.783 **	-0.784 **	-0.784 **	-0.788 **
Alternative tenure measures, employees departing for spin-outs	-0.012	-0.073	0.095	0.127	0.282	0.238	0.238	0.104
Controls, characteristics of employees departing for spin-outs:								
Earnings, team leader, empl. departing to spin-outs x1000	-0.012	-0.012	0	0	0	0	0	0
# of employees departing to spin-outs	-0.083	-0.072	-0.086	-0.089	-0.081	-0.082	-0.082	-0.083
Avg. age, employees departing for spin-outs	0.088	0.092	0.086	0.085	0.078	0.077	0.077	0.079
% males, all employees departing for spin-outs	2.965 **	2.956 **	2.918 **	2.913 **	2.861 **	2.878 **	2.878 **	2.911 **
Avg. education, all employees departing for spin-outs	-0.089	-0.089	-0.105	-0.105	-0.123	-0.124	-0.124	-0.119
Controls, characteristics of all exiting employees:								
Earnings, team leader, all exit x1000	0.144 ***	0.146 ***	0.0001 ***	0 ***	0 ***	0 ***	0 ***	0 ***
Avg. team size, all exit	1.347 *	1.318 *	1.319 *	1.342 *	1.344 *	1.339 *	1.339 *	1.319 *
Alternative tenure measures, all exit	0.539	-0.022	-0.283	-0.333	-0.7	-0.491	-0.491	-0.16
# of employees leaving	0.074 **	0.073 **	0.073 **	0.073 **	0.072 **	0.072 **	0.072 **	0.073 **
Avg. age, all exit	-0.219 **	-0.204 **	-0.194 **	-0.192 **	-0.175 *	-0.181 *	-0.181 *	-0.193 **
% males, all exit	-9.963 ***	-9.758 ***	-9.707 ***	-9.763 ***	-9.58 ***	-9.621 ***	-9.621 ***	-9.696 ***
Avg. education, all exit	-0.347	-0.312	-0.288	-0.284	-0.245	-0.255	-0.255	-0.282
Firm level controls:								
Revenue/worker, (t-1)	-0.002 *	-0.002 *	-0.002 *	-0.002 *	-0.002 *	-0.002 *	-0.002 *	-0.002 *
# employees	-0.030 ***	-0.030 ***	-0.03 ***	-0.03 ***	-0.03 ***	-0.03 ***	-0.03 ***	-0.03 ***
Revenue variance *1000	0.124 ***	0.124 ***	0 ***	0 ***	0 ***	0 ***	0 ***	0 ***
Firm age	1.808 ***	1.740 ***	1.739 ***	1.788 ***	1.666 ***	1.647 ***	1.647 ***	1.683 ***
Avg. age, all employees	0.080	0.067	0.064	0.057	0.053	0.059	0.059	0.071
Avg. education, all employees	1.900 *	1.882	1.855	1.841	1.835	1.85	1.85	1.874
Avg. tenure, all employees	-2.959 ***	-2.567 ***	-2.502 ***	-2.47 ***	-2.235 **	-2.377 ***	-2.377 ***	-2.584 ***
% male, all employees	29.676 ***	29.361 ***	29.263 ***	29.284 ***	29.301 ***	29.34 ***	29.34 ***	29.427 ***
% white, all employees	5.267	5.123	5.12	5.093	5.037	5.019	5.019	5.049
# firms in MSA	-0.014 ***	-0.014 ***	-0.014 ***	-0.014 ***	-0.014 ***	-0.014 ***	-0.014 ***	-0.014 ***
(# firms in MSA)^2 *1000	0.002 ***	0.002 ***	0 ***	0 ***	0 ***	0 ***	0 ***	0 ***
Constant	27.776	27.574	27.843	27.82	27.874	28.131	28.131	28.015
N Observations	11822	11822	11822	11822	11822	11822	11822	11822
R-squared	0.2744	0.278	0.279	0.2790	0.279	0.279	0.279	0.279

Note: Models include firm and year fixed effects. Models use robust standard errors.

*** Significant at the 1% level ** Significant at the 5% level * Significant at the 10% level

TABLE 8
Spin-out Survival Regressions with Alternate Measures of Team Tenure

DV = 1 if spin-out fails in the following year	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Tenure Measure	Min	Max	>1 yr. Tenure	>2yr. Tenure	Cens. +1 year	Cens. +5 years	Cens. +10 years	Cens. +20 years
Explanatory variables:								
Size of spin-out team	-0.071***	-0.053***	-0.059***	-0.056***	-0.063***	-0.063***	-0.063***	-0.063***
Alternative measures, tenure of spin-out team	-0.032**	-0.056***	-0.056***	-0.055***	-0.046***	-0.024***	-0.013**	-0.006*
Controls, characteristics of spin-out team:								
Earnings of team leader x10000	-0.002	-0.001	0	0	0	0	0	0
Avg. age of spin-out team	-0.005**	-0.005**	-0.005**	-0.005**	-0.005**	-0.005**	-0.005**	-0.005**
Avg. education of spin-out team	-0.006	-0.004	-0.004	-0.005	-0.005	-0.005	-0.006	-0.007
% male in spin-out team	-0.032	-0.029	-0.029	-0.03	-0.03	-0.035	-0.037	-0.038
Avg. employment of parent firm(s) x1000	0.001	0.001	0	0	0	0	0	0
Age of parent firm at spin-out birth	-0.058***	-0.045***	-0.047***	-0.045***	-0.051***	-0.059***	-0.063***	-0.066***
Dummy: Age of parent firm is censored	0.022	0.024	0.024	0.023	0.038	0.06	0.061	0.058
Controls, spin-out characteristics:								
Spin-out size at entry	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Spin-out # employees	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***
Spin-out age	-0.153***	-0.151***	-0.151***	-0.151***	-0.151***	-0.151***	-0.152***	-0.152***
Spin-out age^2	0.005	0.005	0.005	0.005	0.005*	0.005*	0.005*	0.005*
# firms in MSA x1000	-0.036	-0.037	0	0	0	0	0	0
# firms in MSA^2 x1000000	0.010	0.010	0	0	0	0	0	0
Constant	-21.4870	-21.5697	-21.549	-21.58	-21.581	-21.871	-21.858	-21.835
N Observations	42624	42624	42624	42624	42624	42624	42624	42624
Log-likelihood	-9242.89	-9237.37	-9238.17	-9236.7	-9239.69	-9241.43	-9242.67	-9243.55
LR chi2(28)	2300.98	2312.04	2310.43	2313.44	2307.4	2303.91	2301.42	2299.68

Note: Models control for year fixed effects relative to 2004.
*** Significant at the 1% level ** Significant at the 5% level * Significant at the 10% level