

Human Capital of Spinouts

by

**Natarajan Balasubramanian
Syracuse University**

**Mariko Sakakibara
University of California, Los Angeles**

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Abstract

This study examines how the human capital of spinout founders and the performance of parent firms affect the success of spinouts by using a matched employer-employee dataset of new ventures covering 7 SIC 1-digit sectors in the United States. Our data cover 29,100 spinouts and 379,800 new ventures formed by lone entrepreneurs in 23 states between 1992 and 2005. We evaluate several components of human capital: outcomes of human capital investments vs. human capital investments, task-related human capital vs. non-task-related human capital, and individual human capital vs. group capital, and examine whether these types of human capital affect spinout performance differently. We find that spinout founder's earnings (an outcome of human capital investment) and industry experience (task-related human capital) prior to spinout formation have strong positive correlations with spinout performance, as measured by size, wage and growth rate. We also find that group experience of spinout founders prior to spinout formation has a positive correlation with spinout performance, though this effect is slightly weaker and smaller than those of spinout founder's earnings and industry experience. The effects of these three measures of human capital are mostly present after controlling for parent firm establishment fixed effects. We find some evidence that the size of parent firm establishments has a positive correlation with spinout performance, but this effect does not hold after controlling for parent firm fixed effects. Finally, we find that founder's earnings, industry experience, group experience and parent firm size are more important during the early stage of spinout formation.

INTRODUCTION

Human capital, such as education, experience, knowledge and skills, has been considered as a critical resource for the success of entrepreneurial firms (Keeley and Roure 1990, Florin et al 2003, Sexton and Upton 1985, Unger et al 2011). Among entrepreneurial firms, spinouts — new firms founded by employees of established firms — have received particular attention from researchers because of their perceived success relative to other types of new firms (Klepper 2002; Agarwal et al. 2004; Chatterji 2008). Perhaps the most prominent spinout is Fairchild Semiconductors, founded by the “Shockley Eight” from Shockley Labs, which in turn have been very successful in generating many successful spinouts of their own, so-called “Fairchildren” (Klepper 2001). The success of spinouts is often attributed to the human capital that their founders developed at their employers before they established the spinouts.¹ For example, Bhidé (2003) found that over 70% of new ventures categorized as the 100 fastest growing private companies had founders who said the ideas for the venture came from experiences and ideas that they gained while working at other companies.

Even though the effect of human capital on the success of spinouts has been increasingly studied, there are several important issues which require further investigation. First, past studies of spinouts have typically focused on a single industry (Unger et al 2011), such as the disc drive industry (Agarwal et al, 2004) and lasers (Klepper and Sleeper, 2005). While single-industry studies can allow researchers to obtain detailed information of human capital that drives spinout performance, it is hard to generalize results from such studies. Second, while human capital is found to be an important determinant of the success of spinouts (Agarwal et al. 2004, Klepper 2009), there are several types of human capital that founders can develop. For instance, spinout

¹ Hereinafter, such employers will be referred to as “parent firms” and the specific establishment that the founders worked at as the “parent firm establishment”.

founders can develop their industry knowledge, task-oriented knowledge and skills at their parent firms. This type of human capital is distinct from more general human capital such as education and work experience, and is considered to be critical for the success of spinouts. Also, since spinout founders work together at parent firms, they can develop “group capital”, i.e. the knowledge of working together developed through working as a team, which can be readily transferred to their spinouts. Such team experience has been found to be critical in determining firm success (Beckman 2006, Eisenhardt and Schoonhoven 1990, Huckman et al. 2009). Though it is important to understand how these different types of human capital contribute to the success of spinouts differently, it is relatively rare that a single study encompasses many different types of human capital (Unger et al 2011). Third, while there are many discussions about the conditions parent firms generate spinouts (Anton and Yao 1995, Cabral and Wang 2008, Klepper and Thompson 2007), we have a limited understanding of how the performance of parent firms may affect the success of spinouts.

This paper contributes to the literature by attempting to address these important issues. We investigate the effect of human capital on the success of spinouts by utilizing US Census Bureau micro-data that have recently become available to researchers. Our data cover 29,100 spinouts formed in 23 states of the U.S. between 1992 and 2005 with which we have complete data.² The data cover a broad set of industries from SIC1 to SIC9. However, given the unique character of mining (SIC1) and government (SIC9), we exclude them from our analysis. This broad coverage allows us to obtain generalizable results. Spinouts are identified using employee-movement data, and are broadly defined as “clusters” of 3 to 20 employees moving

² Note all the numbers of observations are rounded to the nearest 100 to reduce the level of disclosure risk to the U. S. Census Bureau.

from an existing firm to form a “new firm”.³ The data allow us to examine pre-foundation experience of founders at various levels. We contrast these spinouts with new ventures formed by only one founder — lone entrepreneurs — to examine the “pure” individual human capital effect without the influence of group capital. This sample of lone entrepreneurs consists of about 379,800 new ventures. While employer-employee matching data has been used for analysis of spinouts in countries such as Denmark and Brazil (Hirakawa et al., 2010; Dahl and Reichstein, n.d.), to our knowledge, this study is the first attempt to use the US census data for comprehensive analysis of human capital of spinouts. The U.S. is arguably the most entrepreneurially active country in the world; so this analysis may give us important insights into what determines spinout performance.

We categorize human capital into several different types: outcomes of human capital investments vs. human capital investments, task-related human capital vs. non-task-related human capital, and individual human capital vs. group capital, and examine whether these types of human capital affect spinout performance differently.

Using three different measures of the success of spinouts: size, wage, and growth rate, we find that spinout founder’s earnings and industry experience prior to spinout formation have strong positive correlations with spinout performance. We also find that group experience of spinout founders prior to spinout formation has a positive correlation with spinout performance, though this effect is weaker and smaller than those of spinout founder’s earnings. We find that these effects persist even after controlling for parent firm establishment fixed effects. We find some evidence that the size of parent firms has a positive correlation with spinout performance, but this effect does not hold after controlling for parent firm establishment fixed effects. Finally,

³ A more complete description of how spinouts were identified can be found in the “Data, Empirics, and Variables” section.

we find that founder's earnings, industry experience, group experience and parent firm size are more important during the early stage of spinout formation.

This paper is organized as follows. The next section discusses how different types of human capital contribute to the performance of spinouts. The subsequent section describes the data and empirics, and is followed by a description of the results. The last section discusses and concludes.

HUMAN CAPITAL OF SPINOUTS

The important and differentiating resources that new ventures possess often reside in their founders' human capital. This is because their own human capital is typically all that the founders can uniquely bring to the table. At its broadest, human capital can be defined as the result of any investment in "activities that influence future real income [of people] through the *imbedding of resources in people*" (Becker, 1962; italics added). Some relevant human capital which determines the performance of spinouts includes on-the-job training, problem-solving and opportunity-identification abilities, environmental and managerial knowledge, and social and professional networks. In the first subsection, we discuss the role of human capital in spinout performance, including the different types of individual human capital. We then discuss "group capital" of founders, an important type of capital, which may influence performance by assisting in developing individual human capital (through members of the founding group assisting each other with developing knowledge skills) and by directly reducing the investment needed to develop a common way of working at the new venture. Finally, in the third subsection, we briefly evaluate the role of parent firm performance, which like group capital, may influence performance by assisting in developing individual human capital in the founders.

Human capital

Human capital contributes to the performance of new ventures in various ways (Unger et al, 2011).⁴ First, it enhances the founders' capabilities to perform the important entrepreneurial tasks of discovering and exploiting business opportunities (Shane and Venkatraman, 2000). For example, prior knowledge increases founders' entrepreneurial alertness (Westhead et al. 2005) preparing them to discover specific opportunities that other people cannot perceive (Shane 2000, Venkatraman 1997). Second, human capital also affects the founders' approaches to the exploitation of opportunities. For instance, human capital is positively related to the quality of planning and venture strategy, which in turn, positively impacts success (Baum et al., 2001, Frese et al., 2007). Furthermore, human capital is helpful in acquiring other useful resources such as financial and physical capital (Brush et al 2001), and can partially compensate for a lack of financial capital, a constraint for many startups (Chandler and Hanks, 1998). Finally, human capital is a prerequisite for further learning, and assists in the accumulation of knowledge and skills (Ackerman and Humphreys 1990, Hunter 1986).

While human capital has been identified as an important determinant of entrepreneurial success, different types of human capital have differential effects. Unger et al. (2011) argue that

⁴ Though some studies suggest that spinouts should have higher level of human capital relative to other new firms (Agarwal et al. 2004, Klepper and Sleeper 2005, Easley and Roberts 2006, Chatterji 2008, Dencker et al. 2009), there are significant variations in the level of human capital *within* the group of spinout founders. This is not only due to the inherent variation in individual human capital but also because the evidence on whether low or high human capital individuals have higher propensities to form new firms (whether spinouts or otherwise) seems mixed. On one hand, incumbent firms may be able to offer a higher wage or a better career opportunity than new firms, and therefore may be able to attract and retain individuals with higher human capital (Stern, 2004). This is consistent with studies that find that those who transitioned to self-employment had relatively lower wages (Amit, Glosten and Muller, 1990; Amit, Muller and Cockburn, 1995; Evans and Leighton, 1989) or find little evidence for wage differences between would-be entrepreneurs and non-entrepreneurs (Hamilton, 2000). On the other hand, Groyberg et al (2007) finds that higher performing individuals become entrepreneurs at higher rates. Similarly, in a study of the legal services industry, Campbell et al. (2009) find that when higher-earning employees leave a firm, they are more likely to go to a new firm than to an incumbent firm.

outcomes of human capital investments (such as knowledge or skills) should have a greater effect than direct human capital investments (such as education or experience) on the success. Their reasoning is that because human capital investments are indirect indicators of human capital and are, therefore, one step removed, unlike knowledge and skills, which are direct indicators of human capital (Davidsson, 2004). They also make a distinction between task-related human capital such as start-up experience or industry experience and non-task-related human capital such as general education and employment experience (Becker 1964, Cooper et al. 1994), and argue that task-related human capital should have a stronger relationship with the success than non-task-related human capital because founders with high task-related human capital possess better knowledge of customers, suppliers, products, and services within the context of their business (Gimeno et al. 1997). Such human capital is also more relevant in the detection and exploitation of new business opportunities (Shane and Venkatraman, 2000) and facilitates the acquisition of new knowledge within the context of their ventures (Cohen and Levinthal 1990). Unger et al (2011) aggregate results across many studies, and find that the correlation between human capital and success measures is higher for outcomes of human capital investments than direct human capital investments. They also find that task-related human capital has a stronger relationship with the success than non-task-related human capital. They observe that these different types of human capital are rarely compared simultaneously in a single study, suggesting the importance of measuring human capital across many dimensions and comparing their relative contributions to the success. In particular, they show that very limited number of studies examine the outcomes of human capital investment. They also find evidence that the degree of human capital-success relationship depends on industry contexts, suggesting the importance of examining broad sets of industries.

Group capital

Spinout founders have a distinct type of human capital: group capital among the founders. This refers to the experience that the founders have developed by working together as a team. Studies in the literature have shown that the cohesion of a management team is critical in determining firm performance, particularly in new ventures where the operating conditions are usually fast changing and uncertain. For example, Beckman (2006) shows that a founding team's composition influences the firm's behavior and strategy. Similarly, it has been observed that a founding team's composition, size and the way the team members interact impact firm growth and survival (Eisenhardt and Schoonhoven 1990; Eisenhardt and Bourgeois 1988). Furthermore, learning is often embedded within the team and team familiarity improves performance (Huckman et al. 2009). By definition, the initial employees of a spinout have worked together, and hence are likely to have high levels of founding group capital. The strongest evidence of the existence of founding group capital in a spinout is perhaps the formation of the spinout! We expect that group capital among spinout founders will contribute positively to the success of spinouts, and that this effect is independent from that of individual human capital. To our knowledge, the relationship between the level of group capital and spinout performance has not been fully examined.

Parent firm performance

The conditions of parent firms can affect the performance of spinouts by influencing the level of human capital development among the founders, and by changing the kind of individuals who leave their employment to start spinouts. If, as some scholars have argued, knowledge transfer occurs from parent firms to entrepreneurs, better-performing parents are more likely to create better-performing spinouts (Agarwal et al. 2004, Klepper 2007, Franco and Filson 2007).

These studies focus on specific industries, and so it is interesting to examine if this pattern is observed across a broader set of industries. Similarly, the parent firm's performance before startup can affect the nature of human capital of employees that leaves parent firms. One could argue that a poorly performing firm may decrease the incentives for employees to continue at the firm, thus increasing the likelihood of capable employees leaving their parent firms and founding a new firm. In the case of well-performing parent firms, the human capital-spinout performance relationship becomes ambiguous. It is possible that employees learn more at a well-performing firm than at a poorly performing firm. Greater learning may potentially increase the ability of employees to found a new firm and succeed. However, capable employees might choose to stay at well-performing parent firms, leading to relatively poor performance of spinouts. Taking the knowledge-transfer effect and the spinout-generation effect together, we hypothesize that spinouts with better-performing parent firms are more successful.

In sum, the discussions above lead to the following research questions.

- * What type of human capital is important for spinout success? We predict that the outcomes of human capital investment are more important than human capital investment, and task-related human capital is more important than non-task-related human capital for the success of spinouts.

- * Does group capital of spinout founders contribute to the success of the spinouts? We predict that group capital contributes to the success of the spinouts, and this effect is distinct from that of individual human capital.

- * How does parent-firm performance affect the performance of spinouts? We predict that better-performing parent firms generate better-performing spinouts.

We now examine these research questions using two samples covering a broad set of industries.

DATA, EMPIRICS, AND VARIABLES

Data

The primary data for the study come from two micro-level datasets at the U.S. Census Bureau. The first, the "Longitudinal Business Database" (LBD) or the "Business Register" (BR), is the universe of all establishments in the US that have at least one employee. For each year from 1976 to 2005, this dataset contains information on employment and payroll at the establishment. In addition, it contains data on the industry, geography and corporate ownership of the establishment. It does not contain information on revenues or on any other expenditure.

The second, the "Longitudinal Employer Household Dynamics" (LEHD), is a composite matched employer-employee dataset comprising multiple *state-level* databases. This dataset, created under the LEHD program, is maintained by the U.S. Census Bureau with contribution from the various individual participating states. The two relevant databases within the LEHD are (a) the "Employment History File" (EHF), which provides the employment history of *all individuals* that work in establishments in states that participate in this program and (b) the "Employer Characteristics File" (ECF) which contains information on *all employers* (i.e. establishments) in states that participate in this program.⁵ These databases, maintained separately for each participating state, contain quarterly information on employment and payroll for the establishment, and wage information for the individual. In particular, for each individual, for each quarter, the database provides the payroll they obtained from each firm they worked for

⁵ As of 2005, there were 23 states participating in this program.

(identified by the “State Employer Identification Number” or the SEIN).⁶ Like the LBD, the LEHD does not contain information on revenues or on any other expenditure. 1991 is the first year the LEHD data are available for at least 3 states.⁷ The geographical coverage of the data increases over time as more states begin to participate in this program.

Identification of spinouts and lone entrepreneurs

We used two non-overlapping samples in this study. The first sample consisted of “lone entrepreneurs” or single individuals who left a parent firm establishment to start a new venture. The second comprises “spinouts” or new ventures started by groups of individuals who left a parent firm establishment.

We followed a two-step approach to construct the sample of spinouts. We started by identifying new establishments from the LBD. An establishment was classified as a new venture if its first appearance in the LBD occurs after 1976. Given their unique character, we excluded establishments from mining (SIC1) and government (SIC9). The remaining establishments were then classified into “new ventures of existing firms” (establishment belongs to an existing firm) and “new entrants” (all other new establishments).

In the second step, we categorized new entrants into “spinouts” and “other new entrants”. We adopted a conservative approach to identifying spinouts so that we reduced the possibility that a new venture that is not a spinout is mistakenly classified as a spinout. The identification of spinouts was based on employee-movement data from the LEHD. We began by identifying clusters of employees moving from one establishment (‘the predecessor establishment’) to

⁶ Note that individuals can simultaneously work for more than one firm in any given quarter.

⁷ Census confidentiality requirements prohibit disclosure of state-specific information. Public disclosure of LEHD information requires that any disclosed data cover at least 3 states. Also, since the LEHD and LBD data are obtained from different sources different points in time, there may be minor inconsistencies between the two data.

another (‘the successor establishment’) within the same state during a 2-quarter period.⁸ Of these clusters, we restricted our attention to clusters that had between 3 and 20 employees as potential spinouts.

From these clusters, we excluded clusters where the predecessor establishment was too small relative to cluster size (specifically, we imposed a condition that the cluster size be at most 50% of employment at the predecessor establishment) and clusters where the successor establishment was too large relative to cluster size (specifically, we imposed a condition that the cluster size be at *least* 80% of employment at the successor establishment).⁹ These conditions were aimed at reducing the likelihood of simple ownership changes being identified as spinouts. We also excluded clusters where the successor establishment was more than one year old at the time of the employees moving to the establishment. In principle then, these clusters represent groups of employees moving from an existing firm to join a new venture.¹⁰ Since the LEHD is a state-level dataset, it is possible that a single establishment in a state that is classified as a new venture may actually belong to a firm that has establishments in multiple states (and hence, is not a spinout). Hence, the preliminary list of spinouts was then refined by using data from the LBD to exclude any such establishments. Establishments in the resulting list were treated as

⁸ In particular, we adopted the following algorithm to identify this list. From the LEHD, for each individual, for each quarter, we identified the list of all SEINs that that individual obtained a positive pay from. For each individual, for each quarter (“the successor quarter”), we then compared the list of SEINs with the list of SEINs from two quarters ago (“the predecessor quarter”). Any individual with an SEIN in the successor quarter that is not in the list of SEINs from the predecessor quarter was classified as a potential candidate for founding a spinout. Individuals who shared the same predecessor establishment (in the predecessor quarter) and the same successor establishment (in the successor quarter) were combined into a “cluster”.

⁹ Cluster size was defined as the number of individuals in the cluster.

¹⁰ Given the relatively small number of such spinouts, separate analyses of out-of-state spinouts posed significant disclosure risks for the US Census Bureau. Hence, they were excluded from the analysis.

spinouts.¹¹ We then eliminated any spinouts that did not have all the variables we were interested in. The resulting sample had about 142,800 observations belonging to about 29,100 spinouts.¹²

The sample of lone entrepreneurs was constructed in an identical fashion except that we restricted our attention to clusters that had 1 employee. The sample of lone entrepreneurs had about 1,566,700 observations belonging to about 379,800 new ventures.

Empirics

As outlined earlier, we analyzed two separate samples: a sample of lone entrepreneurs and a sample of spinouts. The advantage of analyzing lone entrepreneurs is that we can study the effect of the founder's human capital without any possible confounding effects of group capital. Furthermore, it provides an independent confirmation of findings from the spinouts sample. Our baseline specification for a lone entrepreneur's new venture i in industry j in state s at time t was:

$$\pi_{ijst} = FEARN_i + FINDEXP_i + FAGE_i + FEDU_i + FALIEN_i + FGENDER_i + SINSIZE_{ijst} + SAGE_{ijst} + PSIZE_i + PGRO_i + \vartheta_{jt} + \gamma_s + \epsilon_{it} \quad (1)$$

where:

FEARN is the founder's earnings before the new venture formation,

FINDEXP is the founder's industry experience before the new venture formation,

FAGE is the founder's age at the new venture formation,

FEDU is the founder's years of education,

¹¹ Note that spinouts defined here include both employee startups (i.e. involuntary spinouts or entrepreneurial spinouts) and corporate-sponsored spinouts (i.e. voluntary spinouts or parent spinouts). We do not have data on how these new ventures are financed, so we cannot separate these two types.

¹² In order to reduce the level of disclosure risk to the US Census Bureau, the number of observations have been rounded to the nearest 100.

FALIEN is an indicator of whether the founder is an alien in the US,

FGENDER is an indicator of the founder's gender,

SINSIZE is the new venture's initial size at age 1,

SAGE is the new venture's age,

PSIZE is the size of the parent firm establishment at the new venture formation,

PGRO is the growth rate of the parent firm establishment prior to the new venture formation,

γ_s is state fixed effects, and

ϑ_{jt} are joint SIC3-year fixed effects.

Of these variables, due to Census Bureau disclosure restrictions, we do not present coefficients on FALIEN and FGENDER. However, the coefficients on these variables were always small and statistically insignificant.

The baseline specification for spinouts was identical to that described above with the exception of an additional term FGRP, a measure of the founder's group capital.

$$\pi_{ijst} = FEARN_i + FINDEXP_i + FGRP_i + FAGE_i + FEDU_i + FALIEN_i + FGENDER_i + SINSIZE_{ijst} + SAGE_{ijst} + PSIZE_i + PGRO_i + \vartheta_{jt} + \gamma_s + \epsilon_{it} \quad (2)$$

In addition to these baseline specifications, we estimated several alternative specifications as robustness checks. These are described later in the results section.

Variables

We used three different dependent variables: size (as measured by log employment), log average wage, and growth rate (as measured by the change in log employment).

We used three different categories of independent variables. These are described below.

Founder Variables

This set of variables measures different aspects of the human capital of the founders. In the case of lone entrepreneurs, by construction, all of these measures pertained to the lone founder of the new venture. In the case of spinouts with multiple founders, we used data on the founders with the highest human capital (as measured by earnings two quarters before spinout formation) to construct these measures since it is likely that this founder will have the most significant impact on the subsequent performance of the spinout.¹³

Log Founder's Earnings. This was defined as the logarithm of the total earnings (at the parent firm) of the founder two quarters prior to the formation of the spinout. This is our measure of the outcomes of human capital investment. As human capital theory was originally developed to estimate employees' income distribution from their investments in human capital (Becker 1964), this is the most appropriate outcome measure of human capital investment.

Log Founder's Industry Experience. This was computed as the number of "earnings-adjusted" quarters of experience that the founder had in the SIC3 industry that the spinout belonged to. The number of "earnings-adjusted" quarters in any given calendar quarter was computed as the ratio of the founder's earnings to the average earnings in that SIC3 industry. Hence, individuals with earnings higher than the industry average will have more than one "earnings-adjusted" quarter of experience in one calendar quarter.¹⁴ This is our measure of task-related human capital investment.

Log Founder's Age. This was defined as the age of the founder in the year of the formation of the spinout. This is a measure of non-task-related human capital investment.

¹³ We also tested and confirmed the robustness of our results to using the mean data of all founders.

¹⁴ All experience measures include depreciation at the rate of 15% per period. Also, we computed several other variants of this measure including a simple unadjusted count and found similar results.

Log Founder's Education. This was taken as the imputed number of years of education provided by the US Census Bureau. This is a measure of non-task-related human capital investment.

Log Founder's Group Experience. This variable measures the extent of group capital among the founders of the spinout. Hence, it is not relevant for lone entrepreneurs. This was computed as the number of quarters that at least 40% of the founders of the spinout had worked together at the same establishment two quarters prior to formation of the spinout.¹⁵ This is our measure of group capital.

New Venture and Spinout Variables

Log Employment. This was computed as the logarithm of the number of employees.

Spinout Age. This was defined as one plus the number of years since the first year of the spinout or new venture (so that the minimum age is 1).

Log Initial Size. This was computed as the logarithm of the number of employees in the first year of the formation of the spinout.

Parent Firm Variables

Log Parent Firm Size. This was computed as the logarithm of the number of employees in the parent firm establishment (that the founders worked in prior to forming the spinout) at two quarters prior to formation of the spinout.

Log Parent Firm Growth. This was defined as the annual change in the logarithm of the number of employees in the parent firm establishment at two quarters prior to formation of the spinout.

¹⁵ We computed several other variants of this measure including allowing for all members of the founding group to work together and found similar results.

RESULTS

Lone Entrepreneurs

Table I presents the results for lone entrepreneurs. Model 1 examines the determinants of ventures size as measured by log employment. The coefficients on founder's earnings, founder's industry experience, and founder's education are all positive and significant as is the coefficients on parent firm size. The magnitude of the coefficients on these three founder-level variables is very similar and suggests an elasticity (of size to these variables) of about 1.1%. The coefficient on parent firm size is much smaller with an estimated elasticity of about 0.3%. Interestingly, the coefficient on founder's age is negative and significant. Not surprisingly, the coefficients on the main control variables — initial size and age of the new venture — are strongly positive and significant. Model 2 re-estimates Model 1 by including parent firm establishment fixed effects.¹⁶ Hence, this regression compares within new ventures started by founders leaving the same parent firm establishment and accordingly, controls for all unobserved parent firm establishment level variables such as the average level of human capital, the organizational culture, and the average level of organizational capital at the parent firm establishment. The results in Model 2 are qualitatively similar to those in Model 1. The coefficient estimates on founder's earnings and founder's industry experience stay positive and significant in Model 2; the magnitude of the coefficients suggests an elasticity of 0.5% and 2.3% on earnings and industry experience respectively (vs. 1.1% and 1.2% respectively in Model 1). The strong negative coefficient on age observed in Model 1 is also seen in Model 2. The coefficients on the new venture level variables are very similar to those in Model 1. Given the inclusion of parent firm fixed effects,

¹⁶ Due to the large number of parent firm fixed effects and the large number of lone entrepreneurs, it was not feasible to include joint SIC3-year fixed effects in addition to the parent firm fixed effects. Hence, we included separate SIC3 and year fixed effects in these regressions.

the coefficients on the parent firm variables become statistically insignificant. Turning to the wage regressions in Models 3 and 4, the founder's earnings, industry experience and education are strongly significant and positive. The coefficients on the new venture variables and parent firm variables are in the same direction as those in Models 1 and 2. Finally, the growth regressions in Models 5 and 6 also exhibit positive, albeit smaller, coefficients on founder's earnings and industry experience. The coefficient on founder's age is negative as in Models 1 and 2. Together, these results indicate a strong positive correlation between lone entrepreneur performance and the founder's prior earnings and industry experience. The founder's education appears to have a weak positive correlation with performance. Founder's age mostly shows a negative correlation with performance.¹⁷ The impact of the parent firm variables on lone entrepreneur performance is relatively small.

Spinouts

Table II presents the results about the performance of spinouts. Models 1 to 3 estimate specification 2 with log employment, log wage and spinout growth rate as the respective dependent variables and using data on the founder with the highest human capital.¹⁸ The direction of the coefficient estimates are very similar to those in the corresponding regressions in Table I. Founder's earnings, industry experience and education are all strongly positive and significant. However, in comparison to the results from the sample of lone entrepreneurs, the magnitudes of the coefficients are considerably higher. The elasticity of size to founder's earnings is 6.4%, almost 6 times that found in the sample of lone entrepreneurs; the elasticity of wages and spinout growth rate to founders earnings are almost 4 times and 6 times that of the lone entrepreneurs. The coefficient on founder's age remains negative in all three regressions. In

¹⁷ We do not have a testable explanation for this finding.

¹⁸ Hence, they are analogous to Models 1, 3 and 5 in Table I.

addition to these variables, these regressions also include a measure of group capital. The coefficient on this term is generally positive but not always strongly significant. Parent firm size is positively correlated with spinout performance, and the magnitudes of the coefficients in the size and growth regressions are considerably higher than those in the corresponding regressions in Table I. However, unlike in Table I, the coefficient on parent firm size is of the same order of magnitude as the coefficients on the founder variables. Together, these three regressions provide further support to the evidence in Table I that founder's earnings and industry experience are positively correlated with spinout performance. In Model 4, as a robustness check, we use data on all founders to compute the founder's human capital variables. As before, the coefficients on founders' average earnings and average industry experience are positive and significant while the coefficient on average founders' age is negative. In Model 5, we simultaneously include joint SIC3-year and parent firm establishment fixed effects. The estimated coefficients on founder's earnings and education stay positive while the coefficient on industry experience becomes insignificant.¹⁹ Finally, in Model 6, we examine the determinants of the initial size of spinouts, defined as the number of employees at age 1. The coefficients on founder's earnings, industry experience and group experience are not only all strongly positive and significant but also considerably higher than magnitude than the corresponding coefficients in Model 1. This suggests that these variables are even more important during the early stages of spinout formation. Similarly, the coefficients on the parent firm variables also become statistically significant suggesting their importance in the early stages.

DISCUSSION AND CONCLUSION

¹⁹ Note that this is a stricter control than models 2, 4, and 6 in Table I.

This study examines how human capital of spinout founders and the performance of parent firms affect the success of spinouts by using a matched employer-employee dataset of new ventures covering 7 SIC 1-digit sectors in the United States. Our primary contribution is the simultaneous comparison of the performance impact of several types of human capital: outcomes of human capital investments vs. human capital investments, task-related human capital vs. non-task-related human capital, and individual human capital vs. group capital.

Our study has several important implications. In general, and in line with prior studies we find strong evidence that human capital matters across a broad range of industries. Going beyond this general result, we find evidence that supports the views in studies such as Unger et al (2011) that task-related and outcome measures of human capital matter more to performance. Specifically, we find that spinout founder's earnings (our measure of outcomes of human capital investment) and industry experience (our measure of task-related human capital) prior to spinout formation have strong positive correlations with spinout performance.²⁰ We also find that group experience of spinout founders prior to spinout formation has a positive correlation with spinout performance, though this effect is weaker and smaller in magnitude than those of spinout founder's earnings. To our knowledge, this is the first study to show that group capital has distinct effects over and beyond individual human capital on the performance of spinouts. Importantly, the effects of these three types of capital persist after controlling for parent firm establishment fixed effects, which take into account all unobserved parent firm establishment level variables such as the average level of human capital, the organizational culture, and the average level of organizational capital at the parent firm establishment. Furthermore, we find that these variables are more important during the early stage of spinout formation, consistent with the

²⁰ In contrast, our measures of non-task-related human capital investments — spinout founder's education and age — show weaker or inconsistent results.

notion that the human capital of founders matters most during the nascent stages of the new venture.

Though our regressions reveal only a modest effect of the parent firm establishment size and growth variables on spinout performance, parent firm effects do appear to play a considerable role, particularly in determining the kind of individuals who leave to form spinouts. This is evident in the significant differences in the coefficients between the regressions that include parent firm establishment fixed effects (Model 1 in Table II) and those that do not (Model 5 in Table II). These differences, though not uniformly in any direction, imply that the characteristics of spinout founders are correlated with these fixed effects, and in particular that the spinout founders who leave parent firm establishments that spawn multiple spinouts are different from those founders who leave parent firm establishments that spawn only one spinout.

There are obvious limitations to this study, which suggest future research directions. First, even though we find a correlation between human capital and spinout performance, we don't know whether or not this is the result of high human capital founders leaving their parent firms to form spinouts. To complete the picture of the determinants of spinout performance, we need to understand whether spinouts performs better than other types of new ventures by examining the composition of human capital in different types of new ventures, such as the ones created by diversifying entrants and incumbent firms. Another area of research could be decomposing the role of parent firm fixed effects observed above. In this study, they are mainly a control; however, we could study them in much potentially greater detail.

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TABLE I: HUMAN CAPITAL AND PERFORMANCE OF LONE ENTREPRENEURS

Model	1	2	3	4	5	6
Dependent Variable	Log Employment	Log Employment	Log Wage	Log Wage	Log Growth Rate	Log Growth Rate
<i>Founder Variables</i>						
Log Founder's Earnings	0.011*** (0.001)	0.005*** (0.001)	0.113*** (0.001)	0.070*** (0.002)	0.003*** (0.0002)	0.002*** (0.001)
Log Founder's Industry Experience	0.012*** (0.002)	0.023*** (0.004)	0.163*** (0.002)	0.127*** (0.005)	0.005*** (0.001)	0.009*** (0.002)
Log Founder's Age	-0.106*** (0.003)	-0.092*** (0.006)	0.018*** (0.004)	0.008 (0.008)	-0.033*** (0.001)	-0.032*** (0.003)
Log Founder's Education	0.012*** (0.004)	0.001 (0.006)	0.145*** (0.006)	0.101*** (0.009)	0.003** (0.001)	-0.000 (0.003)
<i>New Venture Variables</i>						
Log Employment			-0.001 (0.002)	-0.170*** (0.002)		
Log Initial Size	0.683*** (0.002)	0.688*** (0.004)	0.014*** (0.003)	0.123*** (0.004)	-0.117*** (0.001)	-0.129*** (0.002)
Age of Spinout	0.084*** (0.001)	0.078*** (0.001)	0.029*** (0.001)	0.016*** (0.001)	-0.024*** (0.0002)	-0.028*** (0.0004)
<i>Parent Firm Estab. Variables</i>						
Log Parent Firm Size	0.003*** (0.001)	-0.007 (0.006)	0.009*** (0.001)	-0.025*** (0.008)	0.001*** (0.0002)	-0.003 (0.002)
Log Parent Firm Growth Rate	(0.002)	0.000 (0.003)	0.002 (0.002)	0.009** (0.004)	0.001 (0.001)	0.000 (0.001)
R ²	0.37	0.63	0.27	0.61	0.04	0.15
N	1,566,700	1,566,700	1,566,700	1,566,700	1,186,900	1,186,900
State Fixed Effects	Yes	No	Yes	No	Yes	No
SIC3-Year Fixed Effects	Yes	No	Yes	No	Yes	No
SIC3 Fixed Effects	No	Yes	No	Yes	No	Yes
Year Fixed Effects	No	Yes	No	Yes	No	Yes
Parent Firm Fixed Effects	No	Yes	No	Yes	No	Yes

*** p<0.01, ** p<0.05, * p<0.1. Coefficients on constant and fixed effects not presented. Standard errors clustered at the venture level. All specifications include gender and alien variables.

TABLE II: HUMAN CAPITAL AND PERFORMANCE OF SPINOUTS

Model	1	2	3	4	5	6
Dependent Variable	Log Employ- ment	Log Wage	Log Growth Rate	Log Employ- ment	Log Employ- ment	Log Initial Size
<i>Founder Variables</i>						
Log Founder's Earnings (H)	0.064*** (0.006)	0.440*** (0.007)	0.0180*** (0.002)		0.017** (0.007)	0.132*** (0.007)
Log Founder's Ind. Exp.(H)	0.022*** (0.004)	0.026*** (0.004)	0.010*** (0.001)		0.004 (0.007)	0.057*** 0.005
Log Founder's Group Exp.	0.018* (0.009)	0.028*** (0.010)	0.004 (0.003)	0.023** (0.010)	0.022* (0.013)	0.056*** (0.011)
Log Founder's Age (H)	-0.122*** (0.014)	-0.064*** (0.015)	-0.040*** (0.005)		-0.070*** (0.020)	0.021 (0.016)
Log Founder's Education (H)	0.028* (0.016)	0.112*** (0.017)	0.016** (0.007)		0.062*** (0.023)	0.028 (0.018)
Log Founder's Earnings (M)				0.061*** (0.010)		
Log Founder's Ind. Exp.(M)				0.037*** (0.000)		
Log Founder's Age (M)				-0.188*** (0.020)		
Log Founder's Education (M)				-0.026* (0.020)		
<i>Spinout Variables</i>						
Log Employment		-0.017*** (0.006)				
Log Initial Size	0.723*** (0.008)	-0.003 (0.008)	-0.0852*** (0.002)	0.731*** (0.010)	0.721*** (0.008)	
Age of Spinout	0.0438*** (0.002)	0.022*** (0.002)	-0.0117*** (0.001)	0.044*** (0.000)	0.030*** (0.003)	
<i>Parent Firm Estab. Variables</i>						
Log Parent Firm Size	0.037*** (0.002)	0.006** (0.003)	0.011*** (0.001)	0.050 (0.040)		0.048*** (0.003)
Log Par. Firm Growth Rate	-0.001 (0.005)	-0.009* (0.005)	0.000 (0.002)	0.020 (0.020)		-0.024*** (0.006)
R ²	0.42	0.47	0.06	0.42		0.18
N	142,800	142,800	113,700	142,800	142,800	29,100
State Fixed Effects	Yes	Yes	Yes	Yes	No	Yes
SIC3-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
SIC3 Fixed Effects	No	No	No	No	No	No
Year Fixed Effects	No	No	No	No	No	No
Parent Firm Fixed Effects	No	No	No	No	Yes	No

H: Highest human capital founder; M: Mean of all founders; *** p<0.01, ** p<0.05, * p<0.1. Coefficients on constant and fixed effects not presented. Standard errors clustered at the venture level. All specifications include gender and alien variables.