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Knowledge Contexts of New Ventures: The Contingent Effects of Founding Team Industry and Academic Experience for Spinout Performance

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Abstract

Extant literature on spinouts has treated industry spinouts and university spinouts as two distinct types of ventures that are founded on different types of human capital. However, founding teams may not consist purely of employees or purely of university faculty but instead may be composed of a combination of industry and academic founders. We explore the impact of founding team experience on new venture performance by peeling the onion and describing the incidence and interactive effects of various types of 'industry' experience, namely target industry experience, related industry experience, and professional service experience. We also assess the impact of shared experiences among

founding team members and their potential moderating effects of certain knowledge contexts on new venture performance. While the intent of this exercise is primarily descriptive, shedding light on spinout incidence and performance across the population of new high tech ventures in the U.S., we anticipate that industry-academic hybrid spinouts have performance advantages over pure industry and academic spinouts. We explore these relationships using data from the Longitudinal Employer-Household Dynamics program that spans all spinout ventures in 30 large states from 1994 to 2008.

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Abstract: Extant literature on spinouts has treated industry spinouts and university spinouts as two distinct types of ventures that are founded on different types of human capital. However, founding teams may not consist purely of employees or purely of university faculty but instead may be composed of a combination of industry and academic founders. We explore the impact of founding team experience on new venture performance by peeling the onion and describing the incidence and interactive effects of various types of ‘industry’ experience, namely target industry experience, related industry experience, and professional service experience. We also assess the impact of shared experiences among founding team members and their potential moderating effects of certain knowledge contexts on new venture performance. While the intent of this exercise is primarily descriptive, shedding light on spinout incidence and performance across the population of new high tech ventures in the U.S., we anticipate that industry-academic hybrid spinouts have performance advantages over pure industry and academic spinouts. We explore these relationships using data from the Longitudinal Employer-Household Dynamics program that spans all spinout ventures in 30 large states from 1994 to 2008.

Introduction

Heterogeneity in the knowledge resources held by firms, results in information asymmetries (e.g. Schumpeter, 1934; Hayek, 1945; Kirzner, 1997) and the development of heterogeneous capabilities (e.g. Agarwal & Shah, 2014) and is central in determining differences in innovation and performance among new ventures. Differences in knowledge resources among new ventures may arise due to the distinct knowledge contexts from which the founding team members may come. In particular, whether or not founding team members come from academia or from industry impact the types of knowledge resources founding team human capital will embody. While spinouts with founders from the target industry reflect knowledge of technical knowhow (e.g. Agarwal, Echambadi, Franco, & Sarkar, 2004; Klepper & Sleeper, 2005), they are distinct for their knowledge of operations and that, which is related to the market conditions (e.g. Moore & Davis, 2004; Agarwal et al., 2004). On the other hand, academic spinouts often lacking knowledge associated with operations and the market, exploit knowledge resources related to novel scientific or specialized basic knowledge (e.g. Lockett, Siegel, Wright, & Ensley, 2005; Shane, 2004; Zucker, Darby, & Armstrong, 2002).

While distinctions between these two knowledge contexts are well recognized, the means through which such knowledge affects new venture performance is still feebly understood. A number of limitations affect such an understanding. First, industry and academic spinouts have been defined a number of ways in the literature. For example, some define academic spinouts as new ventures that have at least one founding team member from academia (e.g. Nicolaou & Birley, 2003; Shane, 2004; Lockett et al., 2005; Wright et al., 2004; Zahra et al., 2007), while others require that the majority of founding team members spinout from academia (e.g. Wennberg, Wiklund, & Wright, 2011). Furthermore, some research on academic and industry spinouts restrict their analysis of such new ventures to those in which the majority of team members come from the same parent organization (Wennberg, Wiklund, & Wright, 2011). Due to the lack of clarity and consistency surrounding the definition of university and industry spinouts, there may be significant overlap across classifications of spinouts when team members come from multiple knowledge contexts. This discrepancy also suggests that previous findings likely lack comparability across studies. In addition to the lack of a consistent definition of academic or industry spinouts, research on academic spinouts has been fragmented and often suffers from sample selection biases associated with institutionally generated data, and thus we still have little clarity as to the true incidence and distribution of academic spinouts. Finally, sampling in extant research ignores those new ventures whose founding teams come from a variety of organizational contexts other than target industry and academia, and as a result we know little about how these spinouts compare to the traditional dichotomy of industry and academic spinouts. Taken together, these limitations have stifled researchers abilities to compare the efficacy of different types of startups.

This paper is intended to be primarily descriptive in nature, in which we ‘peel the onion’ to reveal the industry and academic spinout landscape with a more nuanced consideration of team-level heterogeneity. We have the opportunity to examine a sample of spinouts that reflects the population of spinouts in the US, thus addressing concerns present in extant studies associated with sample selection biases. Furthermore, with this data, we have the ability to construct individual level employment histories so that we may generate measures of team composition of experience, allowing an exploration of the associations among various

combinations of complementary knowledge and their correlations with incidence and performance. In particular we begin by analyzing the effect of knowledge contexts (academic or target industry) on new venture incidence and performance, among the population of new ventures in U.S. high-tech industries. After establishing this baseline, we consider the contingent effects of knowledge contexts on incidence and performance along a number of dimensions: (1) shared experience, i.e. whether or not the majority of team members come from the same parent organization, bringing with them shared tacit knowledge and elements of prior organizational routines; (2) team composition in terms of pure or hybrid combinations of team member experience, that is whether or not teams consist of members coming purely from academia, purely from the target industry, or some combination of both; and (3) the extent to which hybrid spinouts consist of founding team members bringing with them complementary knowledge assets, such as professional service experience, or related non-target industry experience.

Beyond providing value in revealing the incidence of new ventures reflecting these various types of founding teams, we argue that these differences are critical to understanding how knowledge contexts affect new venture performance. This extension provides an opportunity for a deeper understanding of the spectrum of initial knowledge available in a firm, and thus also a better estimate of the differential impact of certain knowledge sources on new venture performance. To provide the descriptive analyses, we classify founders' and founding team members' experiences across academia and target industries, as well as the collection of important contingencies outlines above. We then assess the incidence of new ventures in terms of founding team members' knowledge and team composition characteristics. Finally, we explore the performance implications of founding team knowledge contexts and team composition by examining their effects on firm growth and survival. We examine these relationships using data from the Longitudinal Employer-Household Dynamics (LEHD) program that allows us to construct the career histories of all founding teams in 30 large states from 1994-2008.

Background

Industry and University Knowledge Contexts

Founding conditions are particularly important for understanding firm level heterogeneity and performance differences as 'imprinting' by founding members has consequences for organizational structure, strategy, technology, routines, and culture well into the future (Stinchcombe; 1965; Sastry & Coen, 2000). One well accepted source of imprinting is founding members' prior employment as it likely influences new venture formation (Wennberg, 2009; Agarwal et al., 2004; Burton, Sørensen, & Beckman, 2002; Shane & Khurana, 1999), product-market strategies (Boeker, 1997) and firm survival (Bruder, Preisendorfer, & Ziegler, 1992; Phillips, 2002; Agarwal et al., 2004). Agarwal and Shah (2014) suggest that the effects of prior employment can primarily be attributed to the knowledge contexts of founding team members, which shape the informational advantages that underlie the establishment of a new firm and influence the development of the new venture's capabilities. A knowledge context may be defined as the employment domain from which founding human capital spinout and is associated with the nature of knowledge gained through employment that is subsequently exploited for entrepreneurial purposes (Agarwal & Shah, 2014). As in Agarwal and Shah (2014), we focus on those entrepreneurial endeavors that result in the formation of a new venture. Two important and

distinct knowledge contexts that are highlighted in the spinout literature are those of industries and universities (e.g. Agarwal & Shah, 2014; Wennberg, Wiklund, & Wright, 2011; Clarysse, Wright, Van de Velde, 2011; Zahra, Van de Velde, & Larraneta, 2007; Agarwal et al., 2004; Klepper, 2001).

The industry knowledge context is reflected in employee entrepreneurship or those new ventures whose founding team members spinout to- and come from a particular focal industry (Wennberg, Wiklund, & Wright, 2011; Agarwal et al., 2004; Klepper, 2002). Such a context facilitates the development of knowledge related to target industry-relevant technology, operations, and markets (Agarwal & Shah, 2014; Klepper & Sleeper, 2005). Technical knowledge may be tacit, residing within specific human capital (Clarysse, Wright, Van de Velde, 2011), or such knowledge may be codified into products or patents (Agarwal et al., 2004). Operational knowledge may often be found reflected in organizational or technological routines (Agarwal et al., 2004; Agarwal & Shah, 2014). Finally, market-related knowledge may include managerial skills (Moore & Davis, 2008), entrepreneurial capabilities (Ellis et al., 2008; Franco & Filson, 2006; Agarwal et al., 2004), and other industry-specific knowledge (Agarwal & Shah, 2014). Such operational and market knowledge is likely important for both new venture growth and survival as it supports the firm's ability to identify customer needs and how to deliver on such expectations (Narver & Slater, 1990).

Academic knowledge contexts are those in which 'faculty, staff, or students [] innovate in an academic or non-profit research context, and subsequently found a firm that directly exploits this knowledge' (Agarwal & Shah, 2014: pp1114). Such contexts are distinct from industry knowledge contexts in a number of ways. First, academic contexts do not predispose individuals to the development of operational or market-relevant knowledge (Agarwal & Shah, 2014; Wennberg, Wiklund, & Wright, 2011). Academic knowledge contexts are however associated with the development of technological knowledge (Agarwal & Shah, 2014; Wennberg, Wiklund, & Wright, 2011). As in industry knowledge contexts, technical knowledge from academic environments may reside within scientists themselves (Clarysse, Wright, Van de Velde, 2011), or may be codified into patents (Agarwal et al., 2004). However, more often in academic as opposed to industry knowledge contexts, this technical knowledge reflects novel scientific knowledge that is broader than the narrowly focused industry knowledge, which is often closely tied to the market (Wennberg, Wiklund, & Wright, 2011). As a result academic knowledge while potentially more innovative, without the relevant market knowledge, may not be as efficiently exploited as compared to knowledge coming from the industry context. Thus we expect that spinouts with members coming from the academic knowledge context, because they lack operational and market knowledge as compared to industry spinouts, are more likely to grow slower and will be less likely to survive.

Hypothesis 1a: academic spinouts will grow more slowly than industry spinouts

Hypothesis 1b: academic spinouts will be less likely to survive than industry spinouts

Contingencies of Industry and University Knowledge Contexts

Until now we have only considered spinouts in terms of their founding teams and whether they have come from either industry or academic knowledge contexts. Such an

operationalization ignores the team-level composition of knowledge and human capital, which may have important implications for how knowledge from various contexts may be combined and exploited for entrepreneurial purposes, thus affecting growth and performance outcomes of new ventures. In particular, spinout founding team composition may reflect either pure or hybrid forms of academic and industry human capital, where more ‘pure’ forms reflect new ventures in which founding team members come primarily from either academic or industry knowledge contexts, and ‘hybrid’ forms come from some combination of both. Each of these types of new ventures reflect a distinct set of opportunities for how founding team knowledge can be combined and thus likely yield differences in how founding team knowledge will affect growth and performance. Specifically, we argue that Hybrid spinouts having the unique advantage of having both academic and industry knowledge are likely to possess both some kind of unique basic scientific knowledge resulting from the academic knowledge context, as well as knowledge related to relevant markets as well as operations. This combination of knowledge allows such spinouts to leverage and exploit said scientific knowledge in a way that academic spinouts are unable to. As a result, hybrid spinouts are likely to grow faster and survive longer than academic spinouts.

Research on knowledge spillovers suggests that industry spinouts that have access to knowledge from universities reflect higher growth rates as opposed to those that do not have access to such knowledge (Audretsch & Lehmann, 2005). Thus we expect that hybrid spinouts, because they facilitate the direct access to knowledge generated from the university knowledge context, should also reflect higher growth rates than industry spinouts. We expect the same relationship to hold for survival. Taken together, because hybrids should elicit higher growth and survival rates as compared to spinouts consisting of founders primarily from academic or target industry knowledge contexts, we expect a curvilinear relationship between an increasing percentage of team members from the target industry knowledge context with both survival and growth.

Hypothesis 2a: as the percentage of industry or academic team members increase on a team, we expect a curvilinear relationship with survival

Hypothesis 2b: as the percentage of industry or academic team members increase on a team, we expect a curvilinear relationship with growth

Shared experience is also likely to affect the relationship between various knowledge contexts and new venture survival and growth. It is well established that the performance of workgroups improves over time with joint experience due to the development of coordinative routines and social tacit knowledge (Reagans, Argote, & Brooks, 2005; Huckman, Staats, & Upton, 2009). When members spin out together, they are likely to retain such valuable shared knowledge, allowing them a coordinative advantage over teams without prior shared experiences, and are thus also likely to experience advantages in start-up performance (Philips, 2002; Agarwal, Campbell, Franco, & Ganco, 2013).

The advantages of coordinative capabilities associated with shared experience however may be different for firms spinning out from industry as compared to those spinning out from academia. While such coordinative routines are more likely associated with knowledge related to operations or the market, shared experience in academia provides no such benefits. While

academic shared experience may still bring shared tacit knowledge, it is not likely as useful for new venture performance as such shared experiences would be if coming from the industry knowledge context. Thus we expect that for industry spinouts, as compared to academic spinouts, co-mobility would enhance the relationship between the underlying knowledge context and new venture performance, in terms of both new venture growth and survival.

Hypothesis 3a: the positive effect of shared experience on growth increases as the number of team members from industry increases

Hypothesis 3b: the positive effect of shared experience on survival increases as the number of team members from industry increases

While we have highlighted the value of the academic knowledge context in terms of its likely association with novel scientific knowledge, we have also emphasized its deficiency in its ability to facilitate the development of human capital in this context with the skills and knowledge necessary to effectively leverage novel scientific knowledge (Agarwal & Shah, 2014; Wennberg, Wiklund, & Wright, 2011). In the absence of such, an academic founder's knowledge may be complemented by joining with human capital from other knowledge contexts that bring with them knowledge related to operations and markets. Outside of the target industry knowledge context, which we discussed earlier, knowledge arising from experience in professional services or from related high tech industries may serve as complementary knowledge assets to academic founder's knowledge. When teams are thus comprised of both academic and either professional service or related industry experience, academic founders, who otherwise lack the skills and knowledge necessary, may be able to exploit their novel scientific knowledge and will be more likely to survive and grow as a result.

Hypothesis 4a: the positive effect of professional service experience on growth increases as the number of team members from academia increases

Hypothesis 4b: the positive effect of professional service experience on survival increases as the number of team members from academia increases

Hypothesis 4a: the positive effect of related high tech industry experience on growth increases as the number of team members from academia increases

Hypothesis 4b: the positive effect of related high tech industry experience on survival increases as the number of team members from academia increases

Data

We test the above associative relationships using data from the Longitudinal Employer-Household Dynamics (LEHD) program at the US Census Bureau. This database consists of a collection of administrative records on employer and employee characteristics and wages and approximately reflects the population of new venture spinouts across all industries, excluding federal government agencies, in 30 states. The data link employees and firms for every quarter of their employment between the years 1994 and 2008. This allows us to identify all new entrepreneurial ventures as well as all jobs held by an individual at any point in the data. Because we can construct career histories for all founders, we are thus able to identify the

knowledge contexts from which founding team members are coming, and thus the team-level composition of experience.

A large percentage of spinouts in the US are made into the restaurant and food service industries. To be consistent with existing literature we focus on high-technology spinouts but recognize that non-high-technology industries are also an important area for further research. We identify ‘high-tech’ industries as defined by percentage of high-tech labor force (Heckler, 2005). We also limit our sample to spinouts with a founding team size of less than 30 people. We identify founding team members as those who are employed by the new venture within the first year after startup, and whose wages are greater than \$28,000. We chose \$28,000 as the threshold as it reflects annualized minimum wage, which we argue, allows us to focus on the characteristics of those individuals who are more likely to contribute in a substantive matter to the performance of the new venture –i.e. we wish to exclude support staff and other individuals who may not affect the strategic direction or operations of the firm. For academics, we reduce this threshold to \$15,000 so that we may include graduate students as potential founding team members. Our sample thus consists of over 100,000 spinouts with over 500,000 founding team members, over a period of 14 years. Due to compliance with the US Census Bureau standards and laws associated with disclosure, we are unable at this time to provide a more precise description of our sample.

Measures

Survival. This dummy variable was coded 1 in the year the new venture ceased to exist and 0 otherwise.

New venture size – employment. Growth is measured in terms of the total number of employees reported by the new venture in a given year.

New venture size – payroll. We also measure new venture growth in terms of payroll reported. Payroll is adjusted for inflation.

Academic or industry knowledge context. The academic knowledge context is measured in terms of the percentage of founding team members coming from academia in the period prior to new venture birth. If experience in the immediately preceding year was unknown, we take most recent experience up to three years prior to start up creation. The industry knowledge context is constructed in the same fashion but using target industry experience in the period prior to new venture formation. At the individual level, target industry is coded as 1 when the founder comes from the same industry in which the new venture is established.

Team composition – pure or hybrid. Industry-academic hybrid spinouts are defined through an interaction term between our measures of academic and industry knowledge contexts, that is, when new ventures elicit a percentage of team members coming from both academic and target industry.

Shared experience. Shared experience is measured in terms of co-mobility. Because co-mobility could come from either industry or academia, these variables are constructed independently. Thus, we generate a measure for each the incidence of founder co-mobility from target industry

as well as co-mobility of founders coming from academia. At the team level co-mobility is coded as 1 if there is at least one incidence of co-mobility and 0 otherwise.

Complementary knowledge assets. We identify two potential types of complementary knowledge, professional service and related high-tech. We create dummies for professional service knowledge, and assign a value of 1 if teams have at least one member coming from a professional service industry, and 0 otherwise. For related high-tech, we assign a value of 1 if at least one of the founders comes from a high-tech industry other than the target industry, and 0 otherwise.

Controls. We control for a number of potentially confounding variables including founding team size, startup age, team average founder age, share of team founders that are Caucasian, share of team founders who have a bachelors degree, share of team founders that hold a graduate degree, and founding team average individual earnings in period prior to startup. We also include dummies for year, state, and industry as captured by 4-digit NAICS. We also controlled for potential left censoring of work experience if new ventures were established in the first few years of our data.

Methods

We test our hypotheses for the dependent variables associated with employment and payroll using random effects panel regression models. For survival, which is a discrete variable, we use complementary log-log regression. For all models we specify robust standard errors.

Results

Due to restrictions associated with disclosure, at this time, we are unable to provide explicit detail of our preliminary results. Instead, I will provide a brief and general summary of the evidence supporting (or not supporting) our associative hypotheses.

For hypothesis 1 we find that there is no difference in survival between academic and industry spinouts, where both are found to be positively and significantly related to survival. However for the dependent variables associated with growth, we find that while industry is positively and significantly related to both number of employees and payroll, there is no such relationship for new ventures with founders from the academic knowledge context.

Concerning hypothesis two, we find that there is no difference in survival among pure and hybrid spinouts. That is, pure target industry, pure academic, and industry-academic hybrids are all positively associated with survival. We also find that only pure target industry spinouts are associated with employment and payroll. There is no relationship between either hybrids nor pure academic spinouts (those that consist entirely of academic founders) and employment and payroll.

We find evidence, supporting hypothesis 3, that co-mobility is only important for target industry spinouts. Specifically, when target industry spinouts also have founders with shared experience, they are more likely to grow in terms of number of employees. And further, we find limited evidence suggesting that co-mobility may even be detrimental for the employment

growth of academic spinouts. There are no significant results associated with co-mobility and survival, nor with co-mobility and payroll.

For our last series of hypotheses we find that while professional service experience is associated with growth in terms of employment and payroll, it does not moderate the effects of industry or academic knowledge contexts on new venture performance. We do find however that related high tech experience is both associated directly with performance, and also moderates the relationship between target industry knowledge context and performance, in terms of employment and payroll.

Discussion

While we are unable to explicitly disclose our results at this time, we find preliminary evidence for differences in incidence and performance across different types of spinouts. In particular, while there is no difference in terms of survival across various types of spinouts, a number of important contingencies exist, affecting the associative relationships between academic and industry knowledge contexts and new venture growth.

What is particularly interesting is that these differences in performance lay in contrast to many findings highlighted by extant studies that have necessarily adopted a more fragmented approach in their empirical testing. With our data we have the opportunity and the ability to describe the population of startups across high-tech industries in 30 states in the US. In a future version of this paper we plan to include tables describing the incidence of certain types of spinouts across various knowledge contexts with certain founding team characteristics.

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