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by

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THE PROCESS OF CREATIVE CONSTRUCTION: KNOWLEDGE SPILLOVERS, ENTREPRENEURSHIP AND ECONOMIC GROWTH*

January 2008

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Abstract

Questioning the underlying assumptions of the process of creative destruction, we conceptualize an alternative process of creative construction that may characterize the dynamics between entrants and incumbents. We discuss the underlying mechanism of knowledge spillover strategic entrepreneurship whereby knowledge investments by existing organizations, when coupled with entrepreneurial action by individuals embedded in their context, results in new venture creation, heterogeneity in performance and subsequent growth in industries, regions and economies. The framework has implications for future research in entrepreneurship, strategy and economic growth.

JEL-classification: L16, L21, M13, O11, O40, O57

Keywords: growth, spillovers, creative destruction, entrepreneurship

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The fundamental question in the emerging field of strategic entrepreneurship is how firms combine entrepreneurial action that creates new opportunities with strategic action that generates competitive advantage (Hitt et al. 2002). We confront this question by developing the creative construction approach, which identifies knowledge spillovers as a key mechanism that underlies new venture formation and development at the micro level, and economic growth at the macro level. The development of this framework flows from the recognition that although strategy and entrepreneurship theory abounds with Schumpeterian accounts of creative destruction and incumbent displacement by new entrants, our understanding of new venture emergence and associated externalities is less acute.

By specifying the process whereby ideas, technologies, and structures are rendered obsolete and displaced by new and superior ones, Schumpeter's idea of creative destruction has become the dominant framework for entrepreneurship and economic development. The concept highlights the tension between innovation and selection: innovations of new firms unleash selection pressures on existing firms. The view is particularly powerful in explaining analysis of *what* happens as economic structures change from within; however, it is remarkably silent with regard to mechanisms identifying *how* new entrants emerge, *why* the process of displacement occurs, and *whether* increasing returns to knowledge investments could benefit entrants, incumbents and the economy alike. We identify some implicit assumptions in this approach, and juxtapose these against insights from accepted frameworks in the strategy and entrepreneurship literature to describe aspects of an emerging paradigm that we call creative construction, with knowledge spillovers as the underlying mechanism.

The literature that links knowledge spillovers to entrepreneurship emphasizes that incumbent organizations are an important source of new entrants, particularly when they underutilize the knowledge they create (Agarwal, Echambadi, Franco and Sarkar, 2004; Klepper, 2006; Klepper and Sleeper, 2005; Shane and Stuart, 2002). Building on this work, we identify the endogeneity of entrepreneurial opportunities and action, and the intriguing possibility that

knowledge can be leveraged back to incumbents as spill-ins from entrants. In doing so, we relate knowledge investments to a virtuous cycle of growth at multiple levels. Positing this cycle as one of creative construction, we suggest that in the face of the strategic management of knowledge spillovers across incumbents and entrants alike, displacement and value destruction are less likely as an outcome as is growth of both entrants and incumbents in a virtuous loop of value creation. In doing so, we discuss how the process of creative destruction is but one end of the continuum; with the other end representing a process of creative construction—a process wherein entrants benefit from new knowledge created by incumbent organizations that may otherwise be left unexploited, but where such knowledge spillovers do not necessarily result in the destruction of incumbents. As entrants build on knowledge and networks built in incumbent organizations to create new novel combinations that in a Schumpeterian sense causes the destruction of lesser entities, reverse flows from entrants to incumbents can lead to a dynamic process of growth, and thereby a win-win scenario where the positive externalities of knowledge spillovers are highlighted in the process of both value creation and appropriation.

In identifying knowledge spillover based strategic entrepreneurship (KSSE) as the key mechanism behind the process of creative construction, we make three central arguments. First, in the context of entrepreneurship literature, we identify the symbiotic relationship between individuals (potential founders who are employees) and their knowledge environments and contend that entrepreneurial opportunities, instead of being exogenously available, are endogenously created through knowledge investments. Second, by highlighting that the co-creators of knowledge (incumbent organizations and the individuals that work for them) may each be able to appropriate the value, we contribute to the strategy literature by linking the genesis of firm capabilities to performance, and identifying existing boundaries to value appropriation. Further, due to the intriguing possibility that knowledge *spill-ins* can be strategically managed, we discuss how incumbents may effectively benefit from knowledge spillovers that originate from entrants, and in the process enhance their own competitiveness.

Third, we connect new venture origin, entrant and incumbent performance, and regional and industry growth through the cycle of creative construction. Our contribution to the macroeconomic growth literature is thus in identifying *two* endogenous mechanisms – incumbents' knowledge investments and subsequent entrepreneurial venturing that enables knowledge spillovers and value creation. In contrast to existing growth models that assume passivity in human action and/or exogenous technological advances, we emphasize the need for entrepreneurial action in both generation and appropriation of value, and thus macro level growth. Importantly, we contribute to all three literature streams by drawing attention to the intersection of different units of analyses, since the process of creative construction is enabled when entrepreneurial individuals choose to build on extant knowledge to innovate and found new firms that contribute to macro-level growth by becoming hotbeds of further entrepreneurial activity themselves.

The paper proceeds in the following manner. We first provide a brief review of the process of creative destruction. We then develop the knowledge spillovers view of strategic entrepreneurship (KSSE) by linking the endogenous creation of opportunities to new firm formation due to the intersection of entrepreneurship and knowledge spillovers. The mechanism of KSSE, we argue, underlies the process of creative construction, where linkages to extant knowledge translate, through the founders, to firm level capabilities, growth, and competitive advantage. We proceed to link the process of creative construction to regional and industry level growth, since spillover benefits of the initial knowledge investments are reaped due to strategic entrepreneurship. We then discuss how our work integrates parallel literature streams that have typically focused on different units of analyses, and contribute to each as a result. The integrative model also sheds light on important research gaps that need to be addressed, and our final section is a call for additional effort to help explicate the processes, underlying mechanisms and boundary conditions for growth through knowledge spillovers and strategic entrepreneurship.

**CREATIVE CONSTRUCTION AND THE KNOWLEDGE SPILLOVER VIEW OF STRATEGIC
ENTREPRENEURSHIP**

A Brief Review of the Process of Creative Destruction

According to Schumpeter (1934), entrepreneurship triggers *creative destruction*. The process of creative destruction and ensuing churn results from the creation of value through innovations in new products, services and organizations that inevitably causes displacement or diminishing of the value of incumbent products, services and organizations. The Schumpeterian view implicitly assumes that the value creation generated by the entrepreneurial agent exceeds that contributed by the status quo incumbent; otherwise, the entrepreneurial firm would not survive through the Darwinian process long enough to displace the incumbent(s). Creative destruction highlights the relationship between innovation and selection: innovations of new entrants generate selection pressures on existing firms. Thus entrepreneurial creation and incumbent displacement, or destruction, are intertwined; leading scholars to comment that “Destruction, however painful, is the necessary price of creative progress toward a better material life” (McGraw 2007, p. 501)

Focusing on the destruction aspect has led some scholars to posit that the net benefits of entrepreneurship may be less positive than Schumpeter believed (Aghion and Howitt, 1992; Ferguson, 1988). Implicit in this approach is the assumption of a competitive, zero-sum game where entrant wins are juxtaposed against incumbent losses. If the destruction effect is sufficiently high, the net value creation accruing from entrepreneurship may be very low or even negative; thus having a dampening effect on longer term growth. This view is perhaps best exemplified by Ferguson (1988) who comments on “vulture capitalism,” and focuses on the fragmentation, incumbent displacement and instability of economy that is wrought by the ‘*chronically entrepreneurial*’ semiconductor industry. In this view of mere re-distribution of wealth from incumbents to entrants, not only is there no positive contribution to overall growth and employment, there could be a long term detrimental effect if future growth opportunities are dampened due to under-investment in R&D, lack of scale economies, and lack of coordinated

action for development of process technologies and for government support. This perspective has found theoretical support in the literature related to the information paradox (Arrow, 1962), wherein the public nature of information—its nonrival and nonexcludable properties—cause firms to under-invest in knowledge generating investments due to the negative externalities of knowledge spillovers and creative destruction (Aghion and Howitt 1992). Moreover, at a macro level, the policy implication of the view is that cities, regions and nations should pay more attention to prevent destruction, and less on creation ensuing from entrepreneurship, potentially leading them to erect barriers to entrepreneurship to encourage long-term investments by status quo incumbents (Hart, 2003).

A second assumption of the creative destruction view is that entrants avail themselves of exogenously available entrepreneurial opportunities, much like manna from heaven. In modeling the process of creative destruction, Aghion and Howitt (1992) assume that innovations occur randomly, and entrants arrive at a constant Poisson rate. Indeed, while recognizing that economic structure changes from within, Schumpeter himself is silent on the following questions: Where do the new entrants come from? How do they create value?

In summary, scholarly work on creative destruction rests on twin assumptions of potential zero sum games, and exogenous entrepreneurial opportunities. Even though Schumpeter himself focused on the overall economic structure changing from within, subsequent work at the firm level unit of analysis has focused on the invasion from outside industry and/or regional boundaries, which results in the destruction of incumbents. While not discounting this possibility, the relaxation of these assumptions permits other potential paths of economic progress, wherein destruction of incumbents is not an inevitable result. In order to develop a better understanding of the alternative paths, we first describe the underlying mechanism relating to the knowledge spillover view of strategic entrepreneurship.

The Knowledge Spillover View of Strategic Entrepreneurship

Viewing organizations as knowledge producing and exchanging subsystems (Schulz 2001), the knowledge-based view of the firm argues that competitive heterogeneity is caused by the creation and application of privately held, tacit knowledge (Grant 1996; Spender 1996; Teece, Pisano & Schuen 1997). Implicit therefore is the notion that wealth creation in a firm is a function of its ability to create new knowledge, and exploit it in the market. However, as research indicates, the investment that a firm makes in knowledge related activities has important implications beyond its boundaries. On one hand, organizations often falter in transforming their scientific or industrial knowledge into what Arrow (1962) terms economic, or commercialized knowledge, thus suffering from an ‘abundance of underexploited knowledge’ (Agarwal et. al. 2004). On the other hand, organizations are imperfect repositories of knowledge, due to which private knowledge tends to leak into the environment and become the source of new ventures. These two forces, as captured in our *knowledge spillover view of strategic entrepreneurship* together have profound implications for entrepreneurship, strategy and growth.

Existing Organizations as Knowledge Fountainheads

Existing organizations systematically undertake knowledge investments to generate innovative activity to fulfill their strategic mission. Griliches (1979) formalized the model of the knowledge production function, wherein organizations engage in the pursuit of new economic knowledge as an input to innovative activity. Such efforts to create opportunities involve creating firm-specific intangible knowledge resources by undertaking investments in research and development (R&D). However, not all value created through scientific discoveries is fully appropriated within the investing organization’s boundaries. Various constraints on extant organizations’ abilities to deploy resources prevent them from fully exploiting the inherent value of their knowledge assets (Moran and Ghoshal 1999). In fact, evidence shows that many large, established companies find it difficult to take advantage of all the opportunities emanating from their investment in scientific knowledge (Christenson and Overdorf 2000). For example, Xerox’s Palo Alto Research Center is a poster child of a firm that succeeded in generating a large number

of scientific breakthroughs (a superior personal computer, the facsimile machine, the Ethernet, and the laser printer, among others), yet failed to commercialize many of them (Smith and Alexander 1988; Chesbrough and Rosenbloom 2002).

As a result, existing organizations may be characterized as having an abundance of under-exploited knowledge (Agarwal et al. 2004). Much of the knowledge created may lay dormant within the organizational boundaries, since the constraints that result from existing organizational capabilities, orientation, or cognition may prevent them from pursuing all potential opportunities. Knowledge, however, is different from other resources given its public good characteristic of being non-rival and non-excludable (Arrow, 1962), thus creating spillover opportunities. While spillovers refers broadly to the transfer of economic benefits between parties without compensating payment, knowledge spillovers relate specifically to the external benefits from the creation of knowledge that accrue to parties other than the creator¹. Since organizational investments in knowledge lead to the enhancement of human capital, in the form of technological, social, and cultural capital (Becker 1964; Yli-Renko, Autio & Sapienza 2001), an important conduit for spillovers are the people engaged in the knowledge producing activities. Since human capital resides in the heads of individuals, this knowledge is inherently mobile as personnel are under limited organizational control and free to quit at will (Coff 1997).

New Venture Creation: Knowledge Spillovers and Entrepreneurial Action

Individuals that perceive unexploited opportunities created by knowledge investments by incumbent organizations may choose to venture out armed with the human capital they acquired during their tenure at the knowledge generating organization. Thus, individuals working for existing firms and scientists at research institutions facilitate knowledge spillovers when they

¹ Knowledge spillovers have long been recognized as an important element in stimulating economic development. While knowledge spillovers are critical to models of multi-country development (Aghion and Howitt 1992), international trade (Keller 1988), and agglomeration and de-agglomeration (Krugman 1991), they are central to modern growth theories (Romer 1990; Aghion and Howitt, 1992). Broadly, research has indicated how the possibility to exploit knowledge that has flowed out from its generating source (firms or universities and public research establishments), and is thus environmentally available, enables economic actors to exploit opportunities, thus resulting in an acceleration of economic growth. In fact, in a review of the empirical literature on spillovers, Griliches (1992) concludes that not only is the magnitude of R&D spillovers quite large, but that their social rates of return are significantly above private rates.

engage in the entrepreneurial act of new venture formation. In the above example of the dormant knowledge created by Xerox PARC, each of the breakthroughs made fortunes for many Silicon Valley start-ups (Smith and Alexander 1988; Chesbrough and Rosenbloom 2002). In fact, the notion that knowledge is mobile and, at the end of the day can walk out of the door with a firm's employees is reported in research by Bhide (1994), who found that 71 percent of 100 founders of the 1989 *Inc* 500 fastest-growing private companies in the United States had "replicated or modified an idea encountered through previous employment."

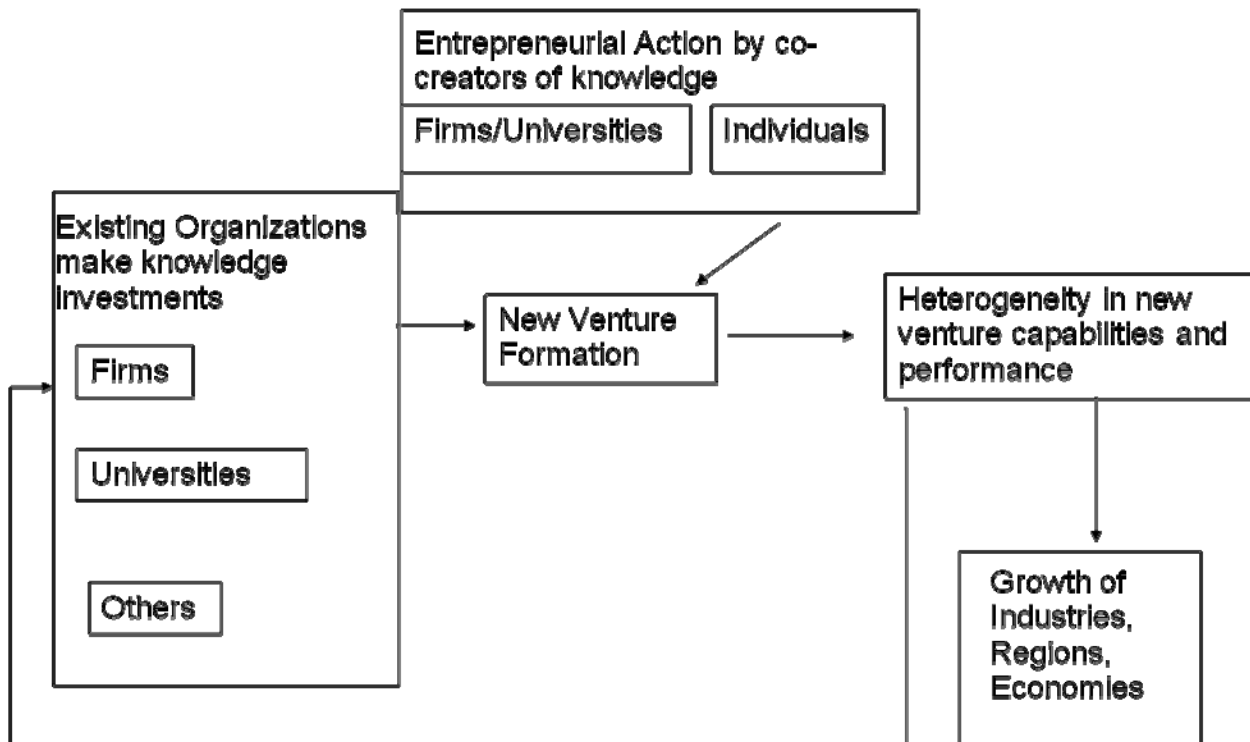
New ventures are a manifestation of the intersection of knowledge spillovers and entrepreneurial action. For example, as Agarwal et. al. (2004) state, "the potential of employee entrepreneurship results from incumbent firms being imperfect and permeable repositories of knowledge, [causing] new organizations to emerge from other organizations" (p. 502). The rich literature streams on *university based spinoffs* (Audretsch and Stephan, 1996; Lockett, Siegel, Wright and Ensley 2005; Louis, Blumenthal, Gluck and Sioto, 1989; O'Shea, Allen, Chevalier and Roche 2005; Zucker, Darby and Brewer 1997) and *firm based spinouts* (Agarwal et. al. 2004; Burton et al., 2002; Chatterji 2006; Klepper, 2006; Klepper and Sleeper, 2005 Shane and Stuart, 2002) illuminate the role that new-firm start-ups play in the commercialization of knowledge investments by academic institutions and existing firms respectively². By starting a new venture, entrepreneurs not only create new firms, they provide a conduit for the spillover of knowledge that might otherwise not have been commercialized and remained dormant in the incumbent firm or organization creating that knowledge in the first place.

² In academic entrepreneurship literature, new ventures are consistently defined as *university spinoffs*. This nomenclature also extends to other science based organizations (e.g. NASA spinoffs). However, in the employee entrepreneurship literature, there is less consistency in the usage of the terms. Different authors have used various different terms—spin-offs, entrepreneurial spin-offs, spin-outs, etc. We prefer the term "spinout" to denote new ventures formed due to employee entrepreneurship for the following reasons. Spinoffs is also widely used in diversification and finance literature to indicate *intended* divestments of business units by existing organizations. While the term entrepreneurial spin-offs mitigates this issue to some extent, it is less illuminating in the context of entrepreneurship literature, where all new ventures are entrepreneurial. Accordingly, we use the term "spinout," which has been used in popular press and by some academic researchers (Agarwal et al. 2004; Franco and Filson, 2007) to denote new ventures resulting from employee entrepreneurship.

The KSSE Framework

Knowledge spillover strategic entrepreneurship (KSSE), illustrated in Figure 1, can thus be defined as the creation of entrepreneurial opportunity based on knowledge generated by investments made by incumbent organizations. It stems from the symbiotic relationship between incumbent firms and other organizations and the people they employ in the knowledge generation process, since knowledge investments by existing institutions enable individuals to jointly create new knowledge, some of whose benefits may be appropriated outside of current organizational structure³.

Figure 1: The Knowledge Spillover View of Strategic Entrepreneurship



³ We note here that the spillover of knowledge is being defined at the organizational level, with the individual scientist or employee acting as the conduit of knowledge spillovers. The actual creation of knowledge or innovation may have been entirely the brainchild of the individual, or it may have had limited input by the individual(s) that ultimately found the new company (In academic entrepreneurship, for example, the first case relates to the academic inventor, while the other may relate to say, a graduate student exposed to the innovation that then seeks to commercialize the invention). However, since the commercial benefits, at least in part, stem from knowledge that originated at another organization, the new venture is termed as stemming from KSSE.

KSSE results in not only in new venture formation, but also heterogeneity in their capability and performance. Imprinted by their experience in extant organizations (Stinchcombe, 1965), founders of new ventures shape new venture capability and performance due to scientific, market based, psychological and social knowledge that bring from their parent organizations, thus resulting in systemic determines heterogeneity in entrant capabilities (Carroll, Bigelow, Seidel and Tsai, 1996; Helfat and Lieberman, 2002; Klepper & Simons, 2000). Path dependency in firm evolution (Cyert and March, 1963; March and Simon, 1958; Nelson and Winter 1982) and endogenous processes of learning-by-doing (Nonaka, 1994; Zollo and Winter, 2002; Winter, 2003) can result in sustained inter-firm variance in structure, strategy, routines, and culture (Sastry & Coen 2000), suggesting that the knowledge stocks at founding leaves a long lasting imprint on a firm's future competitiveness.

These ventures then represent the extant organizations who engage in knowledge investments. The resultant feedback loop fuels industry, regional and economic growth. In contrast to the assumption of zero costs of location choice in spatial models (Hotelling, 1929; Lancaster, 1966; Salop, 1979), KSSE implies that the costs of choosing a location in technological or geographical space are non-zero⁴ The knowledge linkages of new entrants to extant organizations can constrain their ability to occupy non-overlapping segments in the industry or geographical space, due to costs related not only to learning and innovating, but also to those that stem from agglomeration economies and supply chain and infrastructure development. Importantly, since entrepreneurial entrants are embedded in their particular institutional contexts, they are more likely to locate closer to this space (geographical, technological, or preferences scale). It may also be that consumers learn as well, and that their

⁴ Spatial models are useful to conceptualize not just geographical space, but also technological or consumer preference space (Carlton and Perloff, 2006), and can thus help illuminate growth dynamics in industries or regions. In particular, the Salop (1979) model examines competitive dynamics and optimal entry locations when consumers are assumed to be located around a circle representing their geographical or preference space⁴. To maximize monopoly rents, entering firms have the incentive to locate as far away from incumbents as possible, i.e. when two firms compete, they will locate at the end points of a diameter. In general, if the circumference of the circle is unity, the distance between "n" firms will be $1/n$. However, the model makes a critical assumption that entrant firms incur zero costs in their choice of location. In the context of industries and technologies, this is similar to the assumptions that innovations stem from a random process, as in Aghion and Howitt (1992).

preferences may be revealed/developed in part due to their interaction with the firms that offer the products. Thus, in contrast to the model by Salop (1979) where new entrants locate farthest away from existing organizations in a circular space, KSSE results in a gradual spread of firms from anchor points on the circle that represent existing institutions and organizations.

Support for such evolutionary patterns in industries and regions stems from the industry life cycle literature. Scholars have consistently documented the importance of new entrants in the take-off and growth of industries (Agarwal and Bayus, 2002; Audretsch, 1995; Gavin 1983; Carroll et al. 1996; Gort and Klepper, 1982; Klepper 2002), since they are a key vehicle for introducing new innovations into the market (Audretsch, 1995; Gort and Klepper, 1982). In subsequent work, Agarwal et. al. (2004) and Klepper (2002) found systematic differences in entrant success rates, with spinout firms having the highest levels of performance. Importantly, Klepper (2007) documented evidence that spinouts from existing firms tend to be spatially clustered within close geographic proximity to their parents. In particular, Klepper has compared both the formative stages of the automobile industry with those in the semiconductor industry and finds that not only did they generate considerable growth for the surviving new ventures, but also for the region in which those new ventures were spawned. Thus, just as the industry evolves over a life cycle, so too does a region which such an industry is located. As Gordon Moore emphasized, “the central element in the history of Silicon Valley is the founding of a previously unknown type of regional, dynamic, high-technology economy,” which Klepper (2007) shows was fueled by semiconductor spinouts.

Similarly, knowledge spillovers emanating from universities has also been acknowledged to generate not only new venture growth and entire new industries, but also the regions in which they are located. For example, the turnaround in San Diego from a highly depressed region due to naval base closings and downsizings to a high growth region has been attributed to the efficacy of spinoffs from the University of California at San Diego.

KSSE can generate regional and industry growth (and hence growth at more aggregate macro levels of nations and continents) due to two endogenous processes: the first relates to the

knowledge investments made by existing organizations, while the second relates to the entrepreneurial action of individuals embedded in these contexts that result in new venture formation. The implication of the dual need for human action is that there are *non random* patterns of innovation. Subsequent innovations result from initial investments, and further, path dependencies in origins and growth of capabilities imply that industries and regions where these firms operate are going to be differentially advantaged than others. An unequal access to initial knowledge investments by parent organizations creates unequal rates of growth of industries and regions. Thus, differences in technological intensity, for instance, will result in differences in levels of sales achieved in the industry at its peak; just as regional differences in location will result in different levels of economic growth.

The Process of Creative Construction

As reviewed in the earlier section, the process of creative destruction depicts entrants empowered by exogenous sources of innovation as displacing entrants in an interaction characterized by zero-sum and win-lose dynamics. KSSE highlights that entrants often emerge endogenously from existing organizations, armed by knowledge created though underutilized within incumbents. At first glance, KSSE would thus seem very consistent with creative destruction, inasmuch as it relates to entrants appropriating the value created by incumbents. However, KSSE is also consistent with creative construction, wherein the growth of entrants is not necessarily at the expense of the incumbent. We elaborate on this alternative path which, while acknowledged implicitly in scholarly writings, has never fully been articulated as a process wherein synergies develop through the creation of larger pies and win-win dynamics. Creative construction is similar to creative destruction in highlighting the creation of value through entrepreneurial entry; however it differs from creative destruction in two critical ways. First, it identifies the “construction” of these new entrants due to incumbent investments in knowledge. Second, it questions whether incumbents are necessarily destroyed in the process, given the

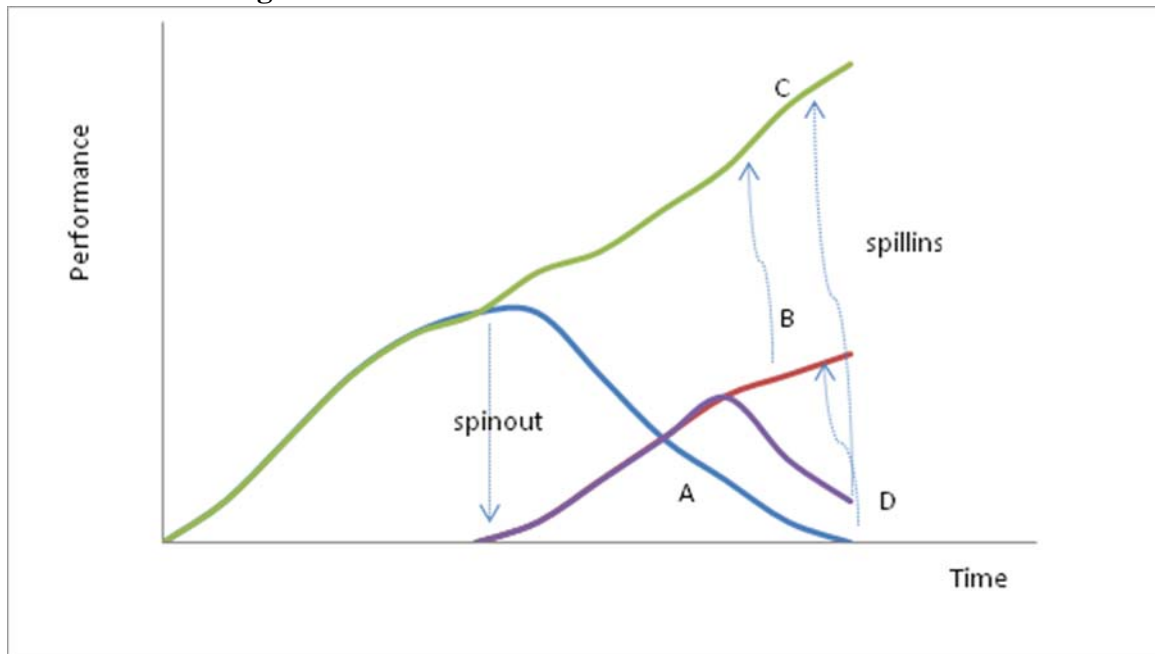
potential for simultaneous growth of both incumbents and entrants alike, and for strategic management by incumbents of the knowledge spillovers that may result in “spill-ins.”

There are at least two reasons for a win-win rather than a win-lose outcome. The first stems from agglomeration and legitimacy effects, which can lead to increase in demand that permits simultaneous growth of both the parent and the progeny. As discussed earlier, industry life cycle scholars have documented the growth of both industries and regions due to entrepreneurial entry (Agarwal and Bayus, 2002; Klepper, 2007). Agarwal and Bayus (2002) show that sales take-off and growth in the industry are linked to a critical mass of entry in the industry, an empirical fact also documented by organizational ecology scholars that theorize about the legitimacy building role of early entrants in the industry (Hannan and Freeman, 1989). Further, scholars have explicitly linked the growth of regions and industries to spinout activity (Brittain and Freeman 1986; Klepper 2007; Saxenian, 1994). They document the positive synergies and agglomeration economies caused due to geographical clusters enabled by knowledge spillover strategic entrepreneurship. As industries and regions grow due to KSSE, they attract not only additional human capital, but also supporting infrastructure related to the supply chain and venture financing. Not only does this serve to reinforce the supply side effects for the incumbent organization, it can lead to enhanced demand of the product they sell. Thus, particularly in the growth stages of the industries, both parent and progeny organizations may grow, and the growth of one is not at the expense of the other.

The second stems from “spill-in” or capability enhancement effects which arise when spinouts occupy complementary rather than competitive positions, and their growth in capabilities provides a potential for learning (and even subsequent acquisition of the spawned firm) by the parent organization. As an example, Gordon Moore stated that “at Fairchild, we began to encourage and support spin-offs that could provide us with necessary components to our research and manufacturing processes. Later, Intel adopted an outright technology policy that we would use none of our own equipment. We knew we couldn’t keep up with too many technologies, or dedicate the resources to be at the leading edge in all areas simultaneously.”

(Moore and Davis, 2004:11). Thus, an incumbent firm may be able to leverage off the capabilities of a spinout it has spawned, and use it as a complementary asset. While much has been documented about spinouts occupying competing positions in the supply chain, recent work by Somaya et al. (2007) has systematically documented that employee mobility to firms that are vertically linked, or produce complements, can have beneficial effects on the incumbents. The incumbent can access new knowledge, competencies and capabilities created in the new venture, by relying on social capital links to the new venture (Somaya et al. 2007). Such linkages, either formally through contractual agreements, or informally through interactions of personnel from both the incumbent and new venture can facilitate the access of valuable know how and competencies generated by the new venture, thereby enabling the “spill-in” of knowledge from the new venture generated by the spillover back to the spawning incumbent.

Figure 2: Creative Destruction and Creative Construction



The alternative paths of creative construction and creative destruction are illustrated in Figure 2, which represents time on the horizontal axis and performance of a firm on the vertical axis. An incumbent’s potential performance path is depicted as initially increasing over time. An

entry event occurs at time t_1 ; if the entrant is a spinout from an existing organization, this is illustrated by the dashed arrow exhibiting the linkages from the incumbent to the new venture. Creative destruction assumes that the incumbent organization follows the path A, while the entrant follows the path B, and in the case of a zero sum, the gains in performance of the entrant exactly equal the loss in performance of the incumbent.

The inter-linkages among the incumbents and entrants through individuals and knowledge spillovers imply some alternative paths. One potential, particularly when incumbents investments result in the creation of more knowledge than they can possibly employ themselves, is that as entrants follow path B, incumbents progress along path C. KSSE suggests that entrepreneurship may not displace incumbents as much as commercialize ideas that otherwise would have remained dormant and unused by incumbents. The assumption that there is a high, immediate, opportunity cost of knowledge spillovers to the incumbent may not be valid in some, if not in most cases, of entrepreneurial ventures. In instances where the knowledge has no *a priori* economic value to the existing organization, but is deemed potentially highly valuable by the individual, entrepreneurship is a constructive force because it increases the value of knowledge and ideas that might otherwise might not have been developed and commercialized. By serving as a conduit of knowledge spillovers, entrepreneurial ventures do not displace or detract from the incumbent firms and industries but rather create new alternatives. This represents creative construction at its most beneficial manifestation, particularly if spillins from spinout entrants fuel incumbent growth through mutually advantageous synergies resulting from agglomeration economies, gains from expanded social networks and complementarities of positions in the value chain.

Importantly, even in the situations where incumbents or entrants have less rosier outcomes, knowledge spillovers between firms ensures that knowledge that is created is constructively used. If entrant firms exhibit pattern D, which is characteristic of liability of newness or adolescence, their experimentation and failure provides for knowledge that continues to live on past their exit from the industry (Hoetker and Agarwal, 2007). Similarly, in the event

that incumbents, for reasons discussed in a later section, fail to systematically harness and appropriate the value they created through their knowledge investments and follow path A, the gains from the investments are not lost due to employee mobility and entrepreneurship.

The dynamics at the firm level also have implications at the more macro levels of regions, industries and economies. The implications for regional growth and performance arise from the idea that greater amounts of KSSE will generate greater spillovers and resultant commercialization of knowledge. As endogenous growth theory (Romer, 1990) suggests, a greater degree of knowledge spillovers will spur higher rates of growth, employment and international competitiveness. Entrepreneurial new ventures are an important mechanism for knowledge spillovers, since their use of knowledge and ideas serves as the crucial resource driving the competitive advantage of the industries, regions and economies that they are associated with. Regions and industries with a high degree of entrepreneurial activity will also facilitate more knowledge spillovers, which will ultimately increase economic growth, employment creation and international competitiveness.

In sum, whether or not KSSE crowds out incumbents, industries, regions and economies or reinforces their competitiveness depends on whether the positive effects of spinouts on incumbent capability and on industry and regional growth are offset by the negative effects due to increased competition. Indeed, whether KSSE results in creative construction or creative destruction of firms, regions and economies rests upon a course dictated by “From each according to their ability (to create), and to each according to their ability (to appropriate).”

IMPLICATIONS FOR ENTREPRENEURSHIP, STRATEGY AND ECONOMIC GROWTH LITERATURE

The preceding section highlighted the virtuous process of “creative construction” and the underlying mechanism of knowledge spillover strategic entrepreneurship. We now turn to the implications of KSSE for core concepts in entrepreneurship, strategy and economic growth literature.

Origin of Entrepreneurial Opportunities

While the concept of entrepreneurial opportunities is fundamental to both entrepreneurship and strategy literature, both literatures have widely divergent views on their origin. In the entrepreneurship literature, opportunities are generally viewed as being given, or exogenous. Acs et al. (2006) and Nelson (1992) trace this bias back to Schumpeter, who specifically eschewed the entrepreneur's role in creating opportunities. According to Nelson (1992: 90), "Schumpeter is curiously uninterested in where the basic ideas for innovations, be they technological or organizational, come from. Schumpeter does not view the entrepreneur as having anything to do with their generation." Recent entrepreneurship work echoes this view with research revolving around the questions, "*How do entrepreneurs perceive existing opportunities and how do these opportunities manifest themselves as being credible versus being an illusion?*" For example, recent literature on individual-opportunity nexus has tended to focus on the process of opportunity discovery so as to explain why some actors are more likely to discover a given opportunity than others (Shane and Eckhardt, 2003), while others have tried to uncover the co-variance between individual characteristics and attributes and cognitive processes underlying the entrepreneurial decision (Shaver, 2003; McClelland, 1961), assuming that entrepreneurship is an orientation towards opportunity recognition (Stevenson and Jarillo, 1990).

In other words, in models of entrepreneurship, there is a tendency to view opportunities as given. The focus is on how heterogeneity in willingness to incur risk, preference for autonomy and self-direction, differential access to scarce and expensive resources influences entrepreneurship at the individual level. After reviewing the entrepreneurship literature, Plummer, Hanie and Godestabois (2007) conclude "A notable lack of research focused on the origins of opportunity," while Companys and McMullen (2007) suggest that, "Despite the advances and the importance of entrepreneurial opportunities to strategy and entrepreneurship, there have been surprisingly few recent studies that explore the nature of opportunities..."

In contrast to the entrepreneurship literature view of the nascent entrepreneur as a taker of the exogenous opportunity, strategy has long viewed firms as creating or making opportunities.

Growth through new entry in markets and products is considered to be a key objective and the heart of any economic enterprise (Mintzberg 1973; Abell, 1980; Penrose, 1959). The quest for *Ricardian rents*, or returns that accrue due to scarcity of the resource (Ricardo, 1817) causes firms to invest in the production of resources such as knowledge that may provide competitive advantage due to their uniqueness, imperfect mobility and lack of imitability (Barney 1991; Penrose, 1959; Wernerfelt, 1984). In the strategy literature, sustained heterogeneity of firms is the cause of sustained competitive advantage (Mahoney and Pandian, 1992) and much of the research has focused on both how firm heterogeneity may be created (Ghemawat, 1991; Teece, 1986; Teece, Pisano and Schuen, 1990) and sustained (Rumelt, 1984; Lippman and Rumelt, 1992). According to Mahoney and Pandian (1992: 374) “A major advancement in the strategy field is the development of models where firm heterogeneity is an endogenous creation of economic actors.” Mahoney and Pandian discuss the potential of both equilibrium (Lippman and Rumelt, 1992; Penrose, 1959) and disequilibrium models (Iwai, 1984; Teece, Pisano and Schuen, 1990) to shed light on this issue.

Incorporating views of strategic action into the equation brings up the intriguing possibility that rather than being opportunity takers as espoused in the entrepreneurship literature, organizations are actually opportunity makers. The key to reconciling entrepreneurship’s view on opportunities vs. the strategy view of entrepreneurship is to adopt the assertion from the strategy literature that opportunities are endogenously created by strategic investments by incumbent firms and research institutions, but then to ask who, and in which organizational context, is able to take advantage of that opportunity.

The knowledge spillover view of strategic entrepreneurship posits that knowledge investments by existing organizations create an abundance of entrepreneurial opportunities, not all of which are fully enacted upon by the parent organization itself. As we will later discuss in this paper, there are many reasons why incumbent organizations, particularly firms that generate knowledge primarily to appropriate its benefits, do not capture all the returns. Thus, in addition to generating *Ricardian rents*, endogenous investments in knowledge generate *entrepreneurial*

rents, or returns that are achieved, in an uncertain or complex environment due to risk taking and entrepreneurial insight (Cooper, Gimeno-Gascon, and Woo, 1991; Rumelt, 1987; Schumpeter, 1934). These entrepreneurial rents accrue to those individuals who may have co-created the knowledge in the existing organizations, and who additionally engage in the entrepreneurial process of harnessing the potential of opportunities that are created, but left unexploited.

Firm Performance

Strategy has been defined as a theory about how to gain competitive advantage; where competitive advantage is the ability to create more economic value than rival firms (Barney and Hesterly, 2006). Since the focus of strategy is on the individual firm, value that is created, but not appropriated does not enter into the measurement of firm performance. Indeed, this definition of competitive advantage would place the economic value attributed to the spinout as value created by “rival” firms, since it misses the link of KSSE between the parent and progeny organizations. However, just as calls for balanced scorecards of organizational performance (Kaplan and Norton, 1992) draw attention to non-financial measures of performance, the knowledge spillover view of strategic entrepreneurship highlights the fact that traditional shareholder value maximization measure of firm performance may underestimate the value created by an organization by not accounting for the spillover benefits it generates.

Brittain and Freeman (1986) conducted an insightful study that examined value creation of two firms—Texas Instruments and Fairchild semiconductor—in the semiconductor industry and showed that the silicon valley phenomenon can be genealogically traced back to Fairchild (and its own parent Shockley Transistor) due to 351 employee entrepreneurs in the 1955-1981 period. The inclusion of the inception and growth of these “Fairchildren” in Fairchild’s creation of value, relative to its rival Texas Instruments that generated very few spinouts during the same period, greatly increases the value beyond the traditional performance measures of profitability or survivability. Hoetker and Agarwal (2007) similarly document the benefits of innovative firms, even after it has exited the industry, in terms of sustained post exit knowledge diffusion.

Indeed, the knowledge spillover view of strategic entrepreneurship is similar to the strategy's view of firm diversification that hails back to Penrose (1959). Mahoney and Pandian (1992) draw attention to the *non-randomness of the direction of a firm's diversification*. Their review of the literature, which includes prior work by Lemelin (1982), MacDonald (1985), Montgomery and Hariharan (1991) and Stewart, Harris and Carleton (1985) provides compelling evidence for Penrose's thesis that resources are a selective force determining the direction of firm diversification. Interestingly, Mahoney and Pandian (1992) also comment that "while the resource-based view has developed a viable approach for explaining and predicting growth and diversification, a 'resource-based theory of divestment' is clearly lacking" (footnote 7, p. 367). While not a resource based theory of divestment as such, the knowledge spillover view of strategic entrepreneurship clearly highlights the role of knowledge spillovers, in the presence of under-exploited knowledge at the parent organization, plays in the *non-randomness of the direction of entrepreneurial new venture formation*, when incumbent organizations choose to forgo opportunities that they created, thus passively divesting their resources.

Boundary Conditions to Value Appropriation

In discussing the process of creative construction and KSSE in the preceding section, we had refrained from addressing the question of "*why do incumbent organizations permit spinout generation and appropriation of the value of their knowledge investments by others?*" Indeed, systematic underutilization of opportunities created by knowledge investments will result in creative destruction rather than creative construction, since incumbents fail to appropriate the value for improving their own performance and survival. For example, among the two types of firms studied by Brittain and Freeman (1986), Shockley Transistor and Fairchild Semiconductor ceased to exist in 1968 and 1979 respectively, while Texas Instruments still lives on.

KSSE provides a rich context within which to examine boundary conditions to value appropriation. In particular, it can complement extant theories of the firm for contributions within each stream. Three theories of the firm are particularly salient in the context of KSSE. These relate to theories of a) managerial diseconomies of scale or the "Penrose effect" on the

limits to firm growth; b) behavioral aspects of the firm that relates to bounded rationality or cognitive limits of managers to perceive opportunities and c) agency issues or incentive alignment of individual and firm objectives.

One reason explaining knowledge spillover strategic entrepreneurship is limited access to managerial resources for appropriating value, which limits the growth potential of the organization (Penrose, 1959). In fact, incumbent firms may be constrained by resources, managerial in particular, in appropriating the benefits of *all* the knowledge that is created. In examining diversification and expansion efforts of firms, scholars have highlighted the dual pulls on managerial resources—the need to manage current operations and maintain size, and the need to engage in expansion efforts to create and identify new opportunities (Agarwal et. al. 2004; Gort, 1962; Hay and Morris, 1979; Marris, 1964; Mahoney and Pandian, 1992). Given specialized skills and need for prior experience, managerial capabilities of the firm may grow at a smaller rate than the opportunities generated, thus causing project and top management teams to have to choose among multiple positive NPV projects. Accordingly, *even in the absence of limited cognition and strategic disagreements or lack of incentive alignment*, existing organizations may be unable to fully appropriate value, resulting in KSSE by individuals who are in the organizational context. This is reflective of Andy Grove’s idea that “there is a rate of growth beyond which every organizational falls apart.”

A second reason relates to organizational inertia, which can be linked to the behavioral theory. Firms often fail to realize their full potential due to various constraints on their ability to deploy resources and exploit the inherent value of their knowledge assets (Moran and Ghoshal 1999). Inertial behavior has been attributed to competency traps (Leonard-Barton 1992; Nelson and Winter 1982) and cognitive limits that constrain managerial decision-making (Barr et al. 1992, Tripsas and Gavetti 2000; Henderson and Clark 1990). Interpreting routines as an embodiment of codifying micro-economic incentives and constraints, as well as being a locus of conflict and governance, Kaplan and Henderson (2005) integrate disparate views on routines, cognitions and incentives to argue that routines and capabilities reflect both “a cognitive (how

things are done) and motivational (what gets rewarded) dimension (Cohendet and Llerena 2003, Dosi et al. 2003)” (p. 513). Accordingly, due to an interaction of existing capabilities, cognitions, incentives and governance issues, incumbent firms face a certain rigidity which renders them unable to take advantage of all the opportunities emanating from their investment in scientific knowledge (Christenson and Overdorf 2000). Due to certain inertial properties that result, they are impeded in their ability to fully realize the value of their knowledge investments (Hannan & Freeman 1984).

From a behavioral perspective, the goals, expectations, and risk averseness of top managers may diverge significantly from those of R&D personnel in the firm. While top management typically emphasize goals salient to external stakeholders that provide critical resources to the organization (Audia & Greve 2001; Greve 1998), scientific personnel are more likely to be driven by aspirations linked closely to the performance of their sub-unit, or the specific technology that they are working on. Reflecting such thoughts, the organizational learning literature describes various pathologies ascribed to competency and learning traps (March, 1991; Levinthal & March 1993) that serve to constrain and localize search for solutions in proximate areas (Ahuja & Lampert 2001; Cyert & March 1963). For example, Christensen (1993) shows how a firm’s dependence on existing customers hampered efforts to re-orient market strategies, and additionally frustrated engineers who did not see their technological inventions being commercialized. Such differences between resource allocating managers and R&D scientists create a tension between exploitation activities that have a far more certain return, and exploratory investments which are riskier, longer term and uncertain. Such risk averseness can inhibit experimentation, and leads to situations where organizations fail to act on radical new solutions (Greve 1998; Greve & Taylor 2000).

A third reason stems from incentive alignment and agency issues. Organizational theorists have long acknowledged the importance of both formal and informal incentives facing a firm’s employees, stressing that the political economy and the social context in which economics and incentive systems of a firm are embedded play a major role in shaping decisions made

(Ancona et al. 1999, Pfeffer 1990). The economic literature suggests that employment contracts only place limited restrictions on an employee's freedom to leave a firm. While firms can impose exit costs on their employees by imposing 'golden handcuffs' or long-term incentives that defer the timing at which the employee receives payments for her knowledge (Milgrom & Roberts 1992; Liebeskind 1996), these mechanisms are subject to agency costs. Problems of moral hazard (Wiggins 1995), and information asymmetries (Anton & Yao 1995) are associated with long-term incentive plans such as deferred stock options, and promises of promotions. These contractual problems make it lucrative for the employee to develop the discovery in her own entrepreneurial venture rather than contracting with the employer to develop it.

Thus, all three theories help address why organizations are limited in their ability to appropriate all the value they create. As Agarwal et al. (2004) state, "an abundance of underutilized knowledge can beget spin-outs, such incidents are deterred when the knowledge of a firm is put to use." We note that the first of the three explanations—managerial diseconomies of scale—is not necessarily a cause of the firm's eventual failure. Indeed, managerial diseconomies to scale as a boundary condition to value appropriation is entirely consistent with creative construction rather than creative destruction, since abounding opportunities generated through knowledge investments permit both the parent and progeny organizations to grow. In fact, to the extent that spillins from spinout activity can be effectively leveraged by incumbent firms, the synergies relax some of the managerial constraints and allow each firm to focus strategically on what to do, and equally importantly, what not to do. However the latter two explanations—organizational inertia due to behavioral limits, and misalignment of incentives—may lead to spinout growth at the expense of the parent, and in the long run, cause the parent organization's failure (Christensen, 1997). An incumbent's inertia and resultant inability to fully exploit its know-how, combined with contractual failures to prevent employees from leaving leads to potential situations where spin-outs may form with the *raison d'être* of exploiting slack incumbent's scientific and technological knowledge in the market. These boundary conditions to value appropriation will result in creative destruction rather than creative construction.

Heterogeneity of Firm Capabilities and Performance

Turning to a core issue in strategy research—namely heterogeneity in firm capabilities and performance—the knowledge spillover view of strategic entrepreneurship links the growth of capabilities, and hence performance, of firms to differences in their founding conditions, or the fountainheads of their knowledge.

Numerous sources generate competitive heterogeneity among firms, and thus result in “enduring and systematic differences in firm characteristics, organization, strategy, and performance among close rivals” (Hoopes and Madsen 2007). From the dominant perspective within the strategy literature, the varied competitive positions that firms enjoy is influenced by the heterogeneous distribution of capabilities across firms. While much has been written about the consequences of capabilities, there has been comparatively little scrutiny on where these heterogeneous capabilities came from in the first place. This is analogous to the paucity of studies identifying where entrepreneurial opportunities come from which was discussed in an earlier section. This lacuna is more apparent in the case of entrepreneurial firms. While firms’ histories, market positions, beliefs and preferences can all generate, and thereby, explain competitive heterogeneity (Rumelt 1994), such legacy based explanations do not explain much as far as start-up firms are concerned.

Further, while the ‘micro’ strand within entrepreneurship research focuses on individual traits that explain new venture creation, the dominant ‘macro’ studies focus on the environmental characteristics. While studies of innovation and market evolution emphasizes the role of entrants as agents of structural market transformations (Gort & Klepper, 1982; Tushman & Anderson, 1986), the origin of entrepreneurial ventures has garnered little attention (Klepper & Simons, 2000). Studies have related new firm formation to market structure (Geroski 1995), technology (Gort and Klepper, 1982; Shane 2000), and population dynamics (Hannan & Freeman, 1987), but there has been little research addressing their origin, or the implications of genealogy.

KSSE fills this gap in the literature since it posits that the entrepreneurial source impacts evolutionary churn by influencing entrant capabilities. Venture origin determines heterogeneity

in entrant capabilities (Carroll, Bigelow, Seidel and Tsai 1996; Klepper & Simons 2000) and initial endowments not only help new ventures withstand competitive pressures during their especially vulnerable initial years, but also imprint on their subsequent behavior and performance (Stinchcombe 1965). By linking the origin of capabilities within existing organizations to the path dependency of capabilities, due to evolutionary theory of the firm (Nelson and Winter 1982) and endogenous experiential learning-by-doing and vicarious learning from other referent firms (Irwin and Klenow, 1994; Ingram and Baum, 1997), the knowledge spillover view of strategic entrepreneurship links new ventures benefits from incumbent experience in their formation to subsequent heterogeneity in their capabilities and performance due to path dependent growth.

When employees leave existing organizations to found a new organization, it is argued that the founders transfers some of the parent's routines to the progeny organization due to which the capabilities of progeny organizations are in part determined by those of their parent organizations. Thus, there are compelling reasons identified in the literature suggesting that firm capabilities and subsequent performance are influenced by the founder's capabilities and knowledge acquired within the context of an incumbent organization but spill over for commercialization in a new organization when a new venture is founded. The genesis of firm capabilities, at least to some extent, has its roots in the capabilities and knowledge of a parent organization. The link between firm performance and the parent organization is KSSE.

Considerable empirical evidence exists supporting the hypothesis that KSSE responds positively to the organizational knowledge context. Holding the degree to which an organization can actually take advantage of the new opportunities it generates from knowledge investments as given, the greater the amount of investment in knowledge resources in an organization the greater the entrepreneurial opportunities generated. Thus, an organization context rich in scientific knowledge would be expected to generate a high degree of knowledge-spillover entrepreneurship. By contrast, an organizational context low in knowledge would not be expected to generate significant knowledge-spillover entrepreneurship. For example, Agarwal et

al. (2004) analyze spinouts from firms in the disk drive industry and find compelling evidence that the performance was greater in spinouts from high-performing firms than from low-performing firms. The high-performing firms provide a more fertile seedbed for entrepreneurial opportunities than do the low-performing firms. Klepper (2006 and forthcoming) similarly finds for the automobile industry that the knowledge capabilities of an incumbent firm influence the subsequent performance of spinouts. A growing literature links the pre-entrepreneurial experience of founders to the actual entrepreneurial performance of the new venture (Burton et al., 2002; Shane and Stuart, 2002). In particular, studies point to two distinct types of knowledge sources which entrepreneurs can draw from to launch a new venture. Burton et al. (2002) find compelling evidence suggesting that entrepreneurs are able to leverage prior career experience in higher performing and status firms into a strategic advantage in terms of obtaining external finance used to launch the new venture. Klepper and Simons (2000), Phillips (2000), Agarwal et al. (2004) and Chatterji (2005) all show that the acquisition of skills, technological capabilities, experience and know how in a high performing incumbent company provide the knowledge basis for spawning a new venture from a high performing incumbent.

Non-Randomness in Patterns of Economic Growth

When David Birch (1981) uncovered his startling (at the time) evidence, that small firms created more jobs than firms, a number of attempts were made to use the Birch analysis to link small business dynamics to regional economic development. However, such studies suffered from a fatal flaw. Among other things, the growth accounting was assumed to take place within distinct firm-size classes, typically large (over 500 employees) and small (with fewer than 500 employees). This ignored the possibility of inter-firm externalities, that one firm's actions could influence productivity and growth in a firm in a different size class. This flaw was particularly glaring in light of the rich scholarly tradition in macroeconomics which has analyzed why some spatial units of analysis perform better than others. After all, public policy does not care which type of firm, large or small generates growth. The main thing is that growth is generated.

However, the mechanism that generates growth in the knowledge spillover view of strategic entrepreneurship are different than those in the traditional macroeconomic growth models. We elaborate below:

Neoclassical economics models focus heavily on the *production-function approach*, where output is modeled as a function primarily of capital and labor. Within this context, early economic growth models related growth in productivity as arising primarily from growth in the underlying inputs: population growth results in an increase in the supply of labor, and savings from current consumption increases future capital stock (Harrod, 1939; Domar, 1946).

Solow (1956) departed from this tradition by calling attention to the empirical evidence that growth rates in capital and labor accounted for only half of the total output growth. Solow's model of exogenous technical change introduced a multiplier term "A" in the traditional production function approach, where A related to the exogenous technological advance parameter that permitted higher economic growth than could be accounted by natural rates of growth in the underlying inputs (Solow, 1956). In other words, in Solow's model, economic growth was a result of "manna from heaven." Thus, early economic growth models explained the growth in the wealth of nations as either caused due to "natural" rates of growth in the underlying inputs, or determined by exogenous shocks of technological advance. A key feature *missing* in both models is the lack of relevance of human action, other than the passive notion of abstinence from current consumption (which leads to savings and increases in capital).

Endogenous growth models represented a marked departure from this tradition. Building on the insights provided by Arrow (1962) regarding the non-excludable and non-rival nature of information, Romer (1990) modeled economic growth as resulting from endogenous investments in knowledge and the subsequent spillover benefits. In Romer's model of horizontal innovation—where new products and varieties are introduced to expand the existing set—the increasing returns to research and development activity stem from spillover benefits captured by organizations other than those making the initial investment in knowledge. Thus, in Romer's

model, economic growth is a consequence of positive externalities of knowledge investments; rather than manna falling from heaven, it blows over from the neighbor.

Another variant of the endogenous growth model is by Aghion and Howitt (1992) who focus on vertical innovation consisting of improvements to existing products and services. Explicitly modeling creative destruction through the “business stealing effect” or the negative externalities imposed by the innovators on the incumbents in the industry. Aghion and Howitt (1992) nonetheless abstract away from the source of the innovation, assuming that innovations arrive randomly (as dictated by a Poisson process) due to research investments. Rather than receiving manna from heaven or it blowing over from the neighbor, their model posits economic growth as resulting from innovative activity of new entrants. But who exactly enters and how they come to enter is never explicitly specified, especially in terms of human actions.

Thus, endogenous growth models improve on the earlier models of growth by providing insights regarding the underlying mechanisms, and importantly, focus on economic growth as being caused by explicit firm action—either due to investments in knowledge by existing organizations, or due to research activity undertaken by new entrants. They advance our understanding of the underlying mechanisms by relating growth to *exogenous* spillovers of *endogenous* investments in knowledge. However, they assume that spillovers merely happen or are randomly generated. Our conceptualization highlights the active role of human or entrepreneurial action in the spillover process; thus, in addition to endogenous investments in knowledge by incumbent organizations, spillovers occur due to subsequent endogenous pursuit of innovation by individuals immersed in these institutional contexts. As a result, economic growth is not a consequence of manna that comes from heaven or blows over from your neighbor, but due to deliberate investment and activity both by incumbent organizations, and by entrepreneurial individuals within these organizations who then carry it over to new entities through founding of new ventures. Entrepreneurship is an important conduit of knowledge spillovers, absent which that knowledge would not have been commercialized, so that there would have been no growth emanating from the investments in knowledge made by incumbent

organizations. Importantly, such a conceptualization draws attention to the fact that economic growth occurs due to *path dependent* action that is local or *non-random* in nature.

As a result, growth at the spatial levels, ranging from cities to regions and countries levels is related to the inception and growth of specific industries and of regions. Thus, growth at more macro levels can only be understood by relating it to the more micro level activity that occurs within industries and regions, that may be seeded due to institutions and organizations occupying the specific space. Entrepreneurship creates not just growth for individuals and new ventures that are launched, but also for the entire region where the KSSE occurs.

AVENUES FOR FUTURE RESEARCH

The emphasis of this paper—that resources are the cornerstone for strategic entrepreneurship in shaping competitiveness and performance, and in particular knowledge resources—is neither surprising nor novel, given the widespread acceptance of the resource-based theory view of the firm (Barney and Clark, 2007; Mahoney and Pandian, 1992; Penrose, 1959). Even the observation that these knowledge resources may be accessed via spillovers has been around since Arrow (1962), and the notion of absorptive capacity (Cohen and Levinthal, 1990) explicitly identifies what firms can do to access knowledge spillovers.

However, in both the resource based view and the notion of absorptive capacity, the firm is assumed to exist exogenously, and the questions relate to strategic enhancement of its performance. By contrast, our knowledge spillover view of strategic entrepreneurship shifts the focus away from knowledge accessed by incumbent firms, both the one creating it as well as other firms making strategic investments to externally access that knowledge. Instead, employees and other individuals endogenously create a new venture to commercialize knowledge that is not highly valued by incumbent organizations. By taking knowledge and capabilities created in the context of one organization to launch a new venture, entrepreneurship serves as a valuable conduit of knowledge spillovers. KSSE not only links the knowledge generated in one organization with the knowledge accessed and used for commercialization and innovation, and

ultimately a strong performance in a different organization, but also the literatures of entrepreneurship and strategy as they coalesce into the scholarly field of strategic entrepreneurship and its implications for economic growth.

In integrating these diverse literature streams, we have attempted to highlight core implications for extant thought. These also present exciting avenues for future research. In particular, we identify three key areas where efforts to develop the scholarly field of strategic entrepreneurship would be particularly beneficial.

From knowledge spillovers to new venture formation:

The first set of questions for future research relate to the linkages from knowledge generation and spillovers in the form of new venture formation, and the strategic decisions in incumbent organizations that are confronted by the inevitability and/or the desirability of KSSE.. While recent attention on the reasons for KSSE (Agarwal et. al. 2004; Franco and Filson, 2007; Klepper, 2006; Lockett et al., 2005; Louis et al., 1989; Shane and Stuart, 2002; Shane, 2004; Zucker et al, 1997) has significantly improved our understanding of why employees and scientists venture on their own, more work is needed to explore additional reasons, and importantly, to reconcile extant explanations for new venture formation. For instance, in the case of employee entrepreneurship, scholars have highlighted selection (Franco and Filson, 2007), abundance of underexploited knowledge (Agarwal et. al. 2004) and strategic disagreements (Klepper, 2007) as causes for new venture formation. However, rather than acting in isolation, these factors may work in tandem, and even reinforce each other. For example, in his account of the reasons for leaving Fairchild to create Intel, Gordon Moore states that “while the catalyst for our Fairchild departure was the politics of internal control, the decision to leave Fairchild was motivated, in large part, by the fact that it had ceased to be the responsive and flexible firm we set out to build” (Moore and Davis, 2004: 8). Similarly, research on academic entrepreneurship highlights differences in scientist likelihood to create startups rather than license their technology, particularly when they perceive the true value of their invention is not

recognized by existing firms (Lowe and Ziedonis, 2006). Research that examines the motives behind KSSE, particularly using a mixture of qualitative and quantitative analysis would be very valuable in increasing our understanding of factors that enable or constrain KSSE.

Additionally, the effect of individual, organizational and environmental factors on the incidence and type of KSSE is an important avenue for future research. At the individual level, there is a need to reconcile KSSE with the parallel stream of literature that examines knowledge spillovers through employee mobility (Almeida and Kogut, 1999; Rosenkopf and Almeida, 2003). While some labor economics models have attempted to address issues of individual choice among alternative options, additional research on the determinants of the choice to engage in KSSE would be fruitful. Also, since new ventures are often founded by *teams* of individuals rather than lone inventors, further research is also needed on the selection process of the founding team members—matching models (Becker and Murphy, 1992) may be a useful tool to gauge how individual complementarities may result in optimal selection choices. At the organizational level, while extant research has examined the effect of parent status and capabilities on the KSSE (Agarwal et al. 2004; Burton et al. 2002; Lockett et al., 2005; Louis et al., 1989; Shane and Stuart, 2002; Shane, 2004; Zucker et al, 1997), additional factors, such as team composition in terms of size and heterogeneity at the parent organization may impact the incidence of spinout formation. Similarly, environmental level contingency conditions include the technological intensity of the industry and region, as well as whether the industry is in the growth or mature stage. Importantly, individual, organizational and environmental factors may interact with each other—for example, KSSE may be more likely when individuals perceive an abundance of such opportunities due to a confluence of organizational (i.e. complementary rather than competitive positioning with parent firm) and environmental support (i.e. growth vs. mature stage of industry life cycle). Alternatively, organizational level strategic decisions regarding intellectual property protection (Ziedonis, 2004) may interact with environmental level policy regarding enforcement of non-compete clauses (Kim and Marschke, 2005) to impact knowledge spillover strategic entrepreneurship. Answers to such questions clearly have both

strategic and policy implications, since they would not only shed light on the tension between knowledge creation and appropriation inherent in situations of co-creation of knowledge by organizations and the individuals embedded in their context, but also highlight the boundary conditions that enable creative construction vs. creative destruction.

Measures of Performance and Growth

New firm entry is a fundamental construct in the Schumpeterian framework (1934), where an exogenous event, such as a scientific discovery, triggers entrepreneurial entry in the form of both *de novo* and *de alio* firms (Carroll, Bigelow, Seidel and Tsai 1996)⁵. As agents of change, these industry entrants increase innovative activity and stimulate growth and development not only within the industry, but also of specific regions where such entrepreneurial activities are located due to spillover effects (Geroski 1995). However, spillovers are a function of resident knowledge in the first place, and if one assumes that today's new ventures are tomorrow's incumbents, the type of knowledge that entrants possess has important implications for the dynamics of spillover led growth. Now, entrants differ with respect to the knowledge they possess at the time of entry, which has been shown to impact the evolution of firm capabilities over time. For example, there is preliminary evidence suggesting that spin-outs, or new firms that are founded by employees of existing organizations as a direct result of knowledge spillovers from incumbents, seem to develop knowledge trajectories that are substantively different from other entrants (Agarwal et al. 2004). Accordingly, one important avenue for research relates to understanding the long term implications for innovation and regional growth as a function of the type of entrants that populate the entrepreneurial landscape. A starting point would be to explore the performance of spin-outs in terms of their innovation input, quality and productivity, as compared to other entrants. Do spinouts have higher innovation productivity compared to their counterparts? Given their heritage, are they more open to disruptive

⁵ Although *de novo* (new start-up entrants) and *de alio* (diversifying entrants from other industries) have some conceptual differences, fundamentally they are both entrepreneurial activity. They reflect differences in modes through which an entrepreneurial opportunity may be exploited (Shane and Venkataraman 2000), but in essence are both Schumpeterian agents.

innovations? Accordingly, are the search patterns of spinouts in knowledge space different from that of other entrants? Behaviorally, having resulted partially from the incumbent inertia, are spin-outs more exploratory in nature? Being more cognizant of the possibility of someone else benefiting from the knowledge that one has invested in, are the internal incentive systems, and resource allocation processes different from other entrants? Do they emphasize a different set of performance criteria, which are less likely to cause a focus on exploitation and drive our experimentation? A corollary would be to investigate whether the innovation performance of spin-outs relative to non-spinouts is contingent on the knowledge intensity of the industry. These questions have larger implications for the regional growth aspect, which as we argued before is conditioned by the type of knowledge generated in a given context, and are therefore important beyond the immediate issue of competitive heterogeneity.

On the other hand, an emerging stream of literature that related past experiences and affiliations of the founding team on the type of innovation pursued by new firms argues that firms whose teams have diverse prior company affiliations are more likely to pursue explorative behaviors and become technical pioneers, compared to a founding team from the same parent which is more often involved in extending and utilizing knowledge from the parent company (Beckman 2006). This raises the intriguing question whether the spillover of parental knowledge is a double edged sword in that while spillovers empower the spinout, it may also have a debilitating effect through constraining the firm through the type of innovation it creates. The tension identified above is fruitful grounds for new research.

Another important arena for future research relates to the way that exit or failure is typically viewed in both the strategy and entrepreneurship literature. When the focus is on the performance of the exiting venture, it is difficult to interpret failure in a positive light. However, emerging literature questions the prevalent bias against firm failure (Davidson, 2003; Hoetker and Agarwal, 2007; Knott and Posen, 2005; Pe'er and Vertinsky 2007). Not only is the demise of less effective organizations or those that engaged in unsuccessful experimentation an integral part of a well functioning market system (Davidson 2003), but creative construction or

destruction can be fueled by failed ventures as much as it is by successful ones (Knott and Posen 2005). While Audretsch and Thurik (2001) and Acs and Audretsch (2003) show that the process of creative destruction creates value at a localized level, recent research has identified spillovers as a mechanism through which failure creates value. Hoetker and Agarwal's (2007) findings that the knowledge contributions of firms live on after their death support the idea articulated by Knott and Posen (2005) that "the knowledge produced by excess entrants while "wasted", in that it is no longer appropriable by the failed firm, may be captured by survivor firms through spillovers." Arguing that failure attracts entrepreneurial entry through the release of resources into a local economy, Pe'er and Vertinsky (2006) make a case for a localized depiction of the process because of immobility of resources, and lower search and transaction costs for local entrepreneurs. In other words, a negative entrepreneurial experience of an individual entrepreneur or investor when viewed from a spillover perspective, may be a positive value creating event when considered from the perspective of lessons learned by serial entrepreneurs, or in the context of the local economy where the exit occurred. Additional research, however, is needed to unravel the mechanisms of such spillovers and quantify the magnitude and extent to which spillovers from failed ventures can act as triggers of growth and renewal.

Similarly, research that explores the linkages between the creation of entrepreneurial opportunities, their implementation through launching a new venture, and the subsequent impact on regional economic growth and development will help quantify the overall performance consequences and social welfare gains of knowledge spillover strategic entrepreneurship. Such research can also examine questions related to strategies pursued by communities, cities, regions and countries to generate hothouses nurturing investments into knowledge along with KSSE that will trigger growth, employment creation and competitiveness. The research agenda shedding light on these questions will be of importance and value not just to scholars of strategic entrepreneurship but also the public policy community charged with creating viable and sustainable economic development. Finally, an important avenue of research is one that is in contrast to the Birch (1981) model of accounting for job generation by small vs. large firms.

Such research could formally quantify the *joint* effect of small and large firms on firm performance and in macro models of job generation, to identify synergies in job creation due to complementarities between small and large firms, rather than substitutability.

Knowledge Spillovers & Open Innovation

The rise of vertically integrated innovation systems within firms where large firms internalized their R&D, product development, and commercialization processes was largely to create entry barriers through economies of scale and scope (Teece 1986; Chandler 1990). The business model revolved around developing a rich technology base through internal R&D, and then developing a commercialization machine within the organization in order to exploit the accumulated knowledge through marketable products. One unintended consequence of this closed system of innovation was that basic research generated spillovers, which as Nelson (1959) noted was beyond the limited ability of funding firms to commercialize and therefore appropriate value. Behavioral and cognitive barriers to innovation, such as the ‘not invented here’ syndrome (Katz and Allen 1985) were recognized as organizational pathologies that were accompanying the Chandlerian model of vertically integrated R&D, and hindering the exploitation of new technology. The consequences, when the technology was not licensed, were unexploited technologies till employees walked out and founded their own firms.

The open innovation model has been portrayed as the antithesis of the traditional vertically integrated model of R&D, product development and marketing. By treating R&D as an open system, where valuable ideas can come from inside or outside the company, and can be commercialized from within the company or by another entity, open innovation assumes that valuable knowledge is widely dispersed, and that regardless of how capable the R&D system of an organization, it must identify, connect, and leverage external knowledge sources as a core process in innovation. In the closed innovation model, however, organizations invested in internal R&D to develop new products and services. Spillovers, a regrettable yet necessary cost of doing business, were an unintended byproduct of the process. In the open innovation system, spillovers are integrated into the company’s business model, and are treated as an opportunity to

expand a firm's core activities, or to spin off a technology and thus create a new business model (West et al. 2005).

In other words, with innovation becoming more complex and recombinant in nature, and with the R&D paradigm shifting towards open systems, the notion of spillovers is under scrutiny. Instead of being considered a cost of doing business, the open innovation system suggests the intriguing possibility that spillovers need to be strategically managed. Traditionally, the imperative has been on firms to design 'golden handcuffs' to prevent employees from leaving the firm with private knowledge and to create structural and procedural barriers to the spillover of internally generated knowledge. Emerging views suggest that spillover potentials be identified, and leveraged through mechanisms such as corporate venture capital or spin-offs, or as through active IP management techniques that treat knowledge as a new class of revenue generating assets (Rivette and Klein 2000).

A whole set of research questions emerge around the notion of knowledge spillover and strategic entrepreneurship in the context of evolving R&D paradigms. What kind of institutional mechanisms can promote open innovation, and the strategic use of knowledge spillovers? What is the changing role of the financial innovation machine in commercializing spillovers in an open innovation system? As R&D gets more outsourced, and innovations become more complex and recombinant in nature, incumbent and potential entrepreneurs are likely to take on more system integrator roles. With the strategic management of spillovers, is the balance likely to shift towards intrapreneurship, or being an entrepreneur within an incumbent organization, rather than spin out from an organization to start one's own venture? Is the long term effect of open innovation be, quite counter-intuitively, to stifle the 'free' spillover of knowledge to the environment, and instead to keep it circulating within a tight network of incumbent corporate entities? From a recipient organization perspective, the traditional view has emphasized how internal R&D enables absorptive capacity, or the ability to identify, assimilate and exploit externally created knowledge (Cohen and Levinthal 1989). Fundamentally though, the firm has always been the locus, and internally generated knowledge the driver of innovation. However,

when external knowledge is afforded an equal role in innovation as internally generated knowledge, the ability of a firm's internal organization to systematically capture spillovers and develop knowledge integration capabilities assumes center-stage. Although university based research has long been recognized as a fountainhead of public knowledge characterized by open disclosure and rapid dissemination, the current trend is towards formal property protection of knowledge and associated secrecy and slowing down technology transfer. Similar questions arise with regard to social welfare and the spillovers from academic research.

A long tradition of research has connected knowledge spillovers to macro economic growth. Regional clusters or the 'concentration of interconnected companies and institutions in a particular field' (Porter 1998, p. 78) are important for spillovers. However, recently, we see a trend towards fragmentation of clusters and de-agglomeration. Partly due to the increasing complexity of knowledge underlying innovation, and partly through forces of globalization that has seen the rise of knowledge clusters in Bangalore in India and Hsinchu in China, knowledge sources have increasingly dispersed away from traditional knowledge clusters. This has important implications for spillover led innovation for firms. While earlier, the imperative was to ensure that a firm was located in the main cluster, say Silicon Valley, so as to take advantage of knowledge spillovers that occurred through formal and informal interactions, and then 'project' products and services based on such knowledge to the rest of the world, the task is far more complicated now.

Fragmentation of innovation clusters, dispersion of knowledge to geographically diverse locations around the world, and technological convergence are combining to create imperatives on firms to capitalize on the diversity of knowledge sources from around the world and connect them into global innovation processes. The requirement now, due to increasing complexity of knowledge and fragmentation of regional knowledge clusters, is to develop what Doz, Santos and Williamson (2001) termed 'metanational' capabilities. With emerging markets serving as 'learning laboratories' of innovation capabilities (Hitt, et al. 2005), developing a global footprint is becoming critical to searching out and mobilizing untapped pockets of technology and market

intelligence that are dispersed across the globe. In parallel, along with pluralism in knowledge clusters, powerful new paradigms of innovation are emerging, such as open sourcing, crowd-sourcing, peer-to-peer production, consumer generated content and collaborative creation.

Voluntary sharing of private knowledge and spillovers form the bedrock of these emerging business models of innovation. Innovation eco-systems, instead of trying to strategically throttle spillovers, are fundamentally based on externalities and the hope that others find value in the pursuit of knowledge created by a focal entity. In other words, the business model of revenue generation is increasingly dependent on strategically managing spillovers so as to create eco-systems around emerging technologies. All these contemporary developments bring into question not only fundamental producer-consumer relationships, conventional theories of firm boundaries, and concomitantly, brings into sharp focus the need to better understand the evolving role of spillovers as fountainheads of not only new firms, but also of powerful forces that are re-shaping geo-political power and global economies.

CONCLUSION

Recent research in academic and employee entrepreneurship has identified the key role of knowledge spillovers in the formation of new ventures, and subsequent growth of industries and regions. In this paper, we present our optimistic view of the process of creative construction due to what we term as knowledge spillover view of strategic entrepreneurship. In reconciling literature streams across entrepreneurship, strategy and growth (of regions, industries, and macroeconomies), we have identified areas in which knowledge spillover strategic entrepreneurship has already contributed to extant literature, and also highlight exciting ways in which the field of strategic entrepreneurship may develop. We hope that other scholars share our vision of the untapped opportunities in the area, and heed our call for additional attention to questions that will inform our understanding of how strategy and entrepreneurship may interface to provide economic growth opportunities.

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