

**INDUSTRY EVOLUTION AND ENTREPRENEURSHIP: STEVEN KLEPPER'S
CONTRIBUTIONS TO INDUSTRIAL ORGANIZATION, STRATEGY, TECHNOLOGICAL
CHANGE AND ENTREPRENEURSHIP**

Rajshree Agarwal

Rudolph P. Lamone Chair and Professor in Strategy and Entrepreneurship
Robert H. Smith School of Business
University of Maryland
4512 Van Munching Hall, College Park, MD 20742
rajshree@umd.edu

Serguey Braguinsky

Associate Professor of Economics
Social and Decision Sciences
Carnegie Mellon University
5000 Forbes Avenue, BP 219B
Pittsburgh, PA 15213
sbrag@andrew.cmu.edu

February 2014

Abstract

In this review of Steven Klepper's contributions in industry evolution, employee entrepreneurship, and geographical clusters, we trace the evolution of his scholarly career. Combining insights from an in-depth interview, our own experiences with him, and our retrospective review, we also note some salient characteristics of the *process* that Klepper employed while undertaking his research projects, an approach we believe was integral to the fundamental insights that are evidenced in the *content* of his scholarly work.

Steven Klepper passed away on May 27th, 2013, when only 64 years old. The three decades of his career represent pioneering research in several streams related to the fields of industrial organization, strategy, technological change and entrepreneurship. In contrast to the neoclassical economics paradigm, Klepper's lifelong work focused on the *dynamics* of industries and on Schumpeterian competition, encompassing individual, firm, industry and regional levels of analysis. In doing so, his aim was to shed light on some critical underpinnings of a capitalist economy.

In this article, we review Klepper's seminal contributions and highlight some features of his workings as a scholar, to help crystallize his legacy. To accomplish this goal, we adopt the prism of his own thoughts, structuring the paper based on his reflections during our interview with him, just a week before his demise (Klepper, 2013a). These reflections set the stage for our review of his work on the industry and firm evolution, employee entrepreneurship, and development of regional clusters, its foundational impact for work by other scholars, and for research agendas deserving of attention by future generations.

As summary observations, we note some hallmark characteristics of Steven Klepper, and his work. A pioneer, Klepper broke away from traditional approaches in both economics and strategy. In doing so, he chartered new territory at their interface which highlights the critical role of innovation and entrepreneurship in the evolution of firms and industries; and hence, of regions and economies. Klepper did so by staying loyal to certain tenets: he coupled careful theorizing, often using formal mathematical logic, with painstaking, often hand-collected, data deep dives that spanned across hundreds of years and thousands of data points. His work never wavered from using the process of seamless integration of inductive data insights with deductive theorizing, representing an evolution of content, and thus demonstrating an exceptional meld of disciplined diligence and intellectual curiosity. The chronological sequence of research areas Klepper pursued show purposeful inquiries into altogether new domains that are nonetheless anchored in his established areas of expertise. There is a clear and logical connection between individual papers, which creates a coherency of concepts and theories even as they encompass multiple units of analysis, spanning across disciplinary and research boundaries.

Our final observation is to the future generation of scholars, who may know Steven Klepper only through his published work. By providing an account of significant milestones in his career, we hope to provide you with Steven's intellectual legacy. By prefacing every section of our review with Steven's own thoughts and ruminations, we share with you his words of wisdom, and his aspirations for the intellectual community he helped create. It is our hope that Steven's traits, which we were fortunate to experience and learn from first hand, inspire you in your quest to conduct impactful work, and in doing so, touch lives in the manner he did ours, and of so many.

INDUSTRY EVOLUTION

An In-depth Empirical Examination of the Phenomenon

Q: "What was it that made you interested in industry evolution to begin with?"

A: "Well, certainly what sparked my interest in industry evolution was Michael Gort. When I started at SUNY Buffalo, he had this incredible data set that now hardly seems like much, but it was a very, very clever way of tracking the number of producers in markets at the time. He used this trade volume that was actually for marketing purposes, found and counted the number of firms listed under a particular manufacturing product line, and did that for years. He was able to come up with a list of about 45-46 products for which you could get a comprehensive list of producers every year. When he gave me the data, the product histories had lots of randomness in them, for a lot of reasons, including that the phenomena were highly random. But it looked to me like you could fit a real shakeout-like process to these data over and over again. It was very complicated by the fact that some products were younger than others, so they may not have progressed very far. But I was pretty convinced that the patterns were incredibly distinctive. I didn't really know what it meant, but I thought it was a great opportunity. So that's how I got involved in industry evolution."

Steven Klepper joined SUNY-Buffalo as a young assistant professor in 1974. For six years, he worked with Michael Gort, until he left in 1980 for Carnegie Mellon University, where he stayed for the rest of his life. This collaboration opened up the field now known as the study of industry evolution. The "incredible data set" Klepper mentions above resulted in their seminal study on trends in the diffusion of product innovations (Gort & Klepper, 1982). The paper represented the first instance in the literature where the "product cycle" notion, a concept that can be dated back to Kuznets (1930), was combined and extended by linking it to the producer-level analysis, and to the notion of the endogenous evolution of industry. Gort & Klepper documented "stylized facts" about

the trends in the number of firms from year to year in 46 different products, recording the relationship between the market structure of the industry and its innovations, patenting and net entry over the product life-cycle. The paper has inspired an entire literature stream investigating industry life-cycle patterns (e.g., Winter, 1984; Nelson, 1994; Agarwal, 1998; McGahan & Silverman, 2001; Murmann, 2003; see also reviews by Caves, 1998; Geroski, 1995; Sutton, 1997). When writing about Michael Gort's contribution to economics, Boyan Jovanovic observed that "Fifteen years later, the Gort-Klepper paper is still state of the art" (Jovanovic, 1998, p. 329). Sixteen years more have passed but we can only repeat this assessment here.

Gort & Klepper (1982) also marked Klepper's first challenge to the neoclassical framework (more on this later) inasmuch as it was the first of the papers in economics to bring in Schumpeterian dynamics, and the explicit recognition of heterogeneity among firms, as they represent internal and external repositories of information. In this process, Gort & Klepper documented what has now become widely accepted as "stylized facts" pertaining to the evolution of an industry; an industry life-cycle starts with Stage I during which one or more major innovations by the product's first producer (or producers) are commercialized. It then goes through Stage II, the period of sharp increase in both the number of producers and total industry output, accompanied by real output price fall which often accelerates toward the end of this phase. The industry then makes transition to maturity (Stages III-V of the life-cycle), often through a "shake-out-like" process, during which the number of producers sharply declines and then stays constant, and both output growth and price declines are much slower. Importantly, by creating a horse-race between five competing theoretical explanations for entry, Gort & Klepper (1982) systematically documented how the above patterns are *not* consistent with the dominant neoclassical theories of the day.

According to at least one very prominent neoclassical economist, the Gort-Klepper findings and their analyses thereof "led to a richer set of conclusions, and a richer set of empirical regularities for theorists to puzzle over" (Jovanovic, 1998). In fact, the "shake-out-like" process first noted by Gort & Klepper in these data alone have motivated many distinct (and highly-cited) papers trying to develop a theory that would explain it (Barbarino & Jovanovic, 2007; Gort & Wall, 1986; Jovanovic

& MacDonald, 1994; Jovanovic & Tse, 2010; Klepper 1996). Within strategic management, the paper serves as an exemplar and a “valuable demonstration of how to derive clear, testable implications from theory, how to creatively and painstakingly collect data that will support a clear empirical test, and how to match theory to real-world stylized facts” (Silverman, 2009).

Another, and still somewhat underappreciated feature of the Gort-Klepper paper is that, to the best of our knowledge, it still remains about the only one (in a large-scale multiple-industry context) where innovations are counted not by using proxies, such as the number of patents (perhaps weighted by the number of citations received), but completely independent of patent data from hand-collected primary sources, carefully distinguishing between major and minor innovations at that. This, in particular, makes it possible to compare trends in generating innovations, on the one hand, and deciding to seek patent protection, on the other hand, over the product life-cycle. One of the most remarkable patterns in the Gort & Klepper counts of innovations and patents is that patents exhibit a strong tendency to increase over the product life-cycle but innovations (especially major innovations), if anything, exhibit the opposite pattern. As Agarwal & Shah (2013) discuss, and consistent with Gort & Klepper (1982), the smaller size of the market and uncertainty regarding the potential of the technological applications (Agarwal & Bayus, 2002; Jaffe, 2000; Merges & Nelson, 1990) may cause innovators to underestimate the returns from establishing property rights through patents (Shah & Torrance, 2013). However, as the industries mature and grow in size, the returns from patenting increase (Hall & Ziedonis, 2001; Jaffe, 2000) not only due to increased marginal returns from larger size of the market (Jaffe, 2000), but also due to increasing strategic importance of patenting stemming from increases in thickets of intellectual property rights, cumulativeness of innovations or even rent seeking (Hall & Ziedonis, 2001; Ziedonis, 2004; Bodrin & Levine, 2008).

Developing a Theory of Industry Evolution: An Industrial Organization Perspective

Q “Please name one or two things you are glad about in your professional career.”

A “The paper in the 1996 American Economic Review. I am very proud of that paper--I brought together a lot of different ideas that said you could explain by them the common patterns, like a theoretical perspective. I think that’s got me a lot of respect.”

Gort & Klepper (1982) documented the now classic industry (product) life-cycle, but it contained little more than a sketch of a conceptual framework explaining this pattern. It took Klepper some time to come up with a comprehensive and mathematically rigorous theory to explain these patterns, and this is what he eventually did in his 1996 American Economic Review paper (Klepper, 1996). Parts of the theoretical framework were anticipated in Klepper & Graddy (1990), and Klepper & Cohen (1992), while other parts progressed in parallel with the work in Cohen & Klepper (1996a, 1996b).¹

Klepper & Graddy (1990) model entrants as having limited capacity, and with an initial draw of different cost realizations. In subsequent periods, those with higher costs can imitate their more efficient peers. Coupled with a minimum efficient scale of production, the model results in only the most efficient (lowest-cost) firms surviving in the long run, which is also when new entry ceases. As the first effort at theorizing, Klepper & Graddy (1990) was basically not much more than a restatement of a long-run industry competitive equilibrium, with an additional assumption of limited firm capacity at each point in time.

Cohen & Klepper (1992), in contrast, focused effort on the empirics of industry R&D. Here, Klepper first articulated the idea that total rents earned through R&D are proportional to firm sales, resulting in larger firms having more incentives to invest in R&D than smaller firms (p. 784). In work concurrent to Klepper (1996), Cohen & Klepper (1996a) further refined both their theory and empirical analyses of the relationship between R&D and firm size. Also, in Cohen & Klepper (1996b), they made a key conceptual distinction between product and process innovation. In contrast to the framework adopted in previous studies (including that of Cohen & Klepper, 1992), where product and process innovations were treated symmetrically, with both increasing the margin between the consumer's willingness to pay and the producer's unit cost, Cohen & Klepper (1996b)

¹ Michael Gort's independent & much earlier attempt to do the same (Gort & Wall, 1986) deserves to be mentioned here as well. For reasons that perhaps have more to do with the often mysterious ways in which scientific awareness is galvanized, rather than quality of the work itself, Gort & Wall's paper has remained almost entirely ignored by the subsequent literature (as of February 2014, it only had 50 Google citations, as opposed to 1,255 for Gort & Klepper, 1,963 for Klepper, 1996, & 723 for Klepper & Graddy, 1990).

explicitly recognized that product innovation, such as new characteristics added to an existing product, serves to attract completely new buyers, not just increase the willingness to pay by existing buyers. The rents to product innovation thus become partly independent of firm size (which is determined by its sales of existing products and which fully determines returns to process innovations), creating novel implications for firm and industry dynamics.

The models developed in work joint with Graddy & Cohen informed the theory development in Klepper (1996), where the above non-trivial ideas about firm heterogeneity are combined with a dynamic model of industry evolution. In this paper, Steven sought, in what became a hallmark characteristic in his subsequent papers as well, to build an ambitious and comprehensive theoretical framework to explain regularities regarding the evolution of new industries and also to derive additional testable propositions through mathematical modeling logic. Eschewing the assumption of firm homogeneity, Klepper built a model wherein firms are endowed with different capabilities to innovate, and seek to satisfy heterogeneity in demand by engaging in product innovation that result in price premiums. While the product innovation advantage erodes across periods, firms also engage in process innovation designed to lower the average cost, with returns proportional to production. The formal model specifies each firm's optimal choice of investment in product and process innovation as well as in increasing its market share. These choices determine the law of motion for the firm size, while the demand side of the market leads to the decline in equilibrium price and generates the rule governing exit. Starting from the underlying firm-level analysis, Klepper was thus able to tie together individual firm dynamics and path dependencies to obtain an evolving (but meeting all the formal criteria of the neoclassical economics) industry equilibrium. The first six propositions then parsimoniously explain the motivating stylized facts about the patterns of entry, exit, product and process innovation.

A hallmark of meaningful theory development (e.g., Samuelson, 1947) is a model that generates hitherto unexpected implications. The Klepper (1996) model is an exemplar in this regard, inasmuch as propositions 7-10, dealing with “cross-sectional regularities,” were not part of the earlier documented stylized facts but nonetheless turned out to be consistent with empirical findings.

Klepper provided an explanation for heretofore hard to explain fact that larger firms invested more in R&D than small firms despite lower marginal returns. Remarkably, this explanation is a by-product of the model where “the lower average productivity of both product and process R&D in larger firms is a reflection of a competitive advantage conferred by firm size” (p. 377). The greater profits earned by firms from process R&D enable them to survive despite being less competent in terms of product innovation.

Importantly, Klepper reconciled evolutionary economics with work on product and process innovation by technology management scholars (Utterback & Abernathy, 1975; Utterback & Suarez, 1993), and offered an intriguing counter-explanation to the dominant design inducing shakeouts in industries. In Klepper’s view, there was a reversal of cause and effect: dominant designs were caused by increasing economies of scale from process innovation and resultant exodus of firms, rather than the cause of specialization and production economies. While the issue still remains debated (Agarwal & Tripsas, 2008), the formal model provides an internally consistent, supply driven explanation for evolving industries, rather than it being an outcome of experimentation based on user preferences.

Firm Heterogeneity and Industry Evolution: An Increasing Focus on Strategic Management

Q. Your work has spanned both economics and strategy disciplines but overall it seems to have resonated more with strategy than with mainstream economics. Why do you think this is the case?

A. I think strategy has always been very empirically oriented. The priorities of strategy were rigorous empirical work first and theorizing second so they were always willing to make some compromises in terms of theory versus empirics. I think economics has had exactly the opposite bias that pure theory is almost always first and empiricism second and so I think when you compare the two, my work was naturally favored more by strategy people.

In addition to the differences in relative weights for theory vs. empirics across disciplines, Klepper gave primacy to underlying firm heterogeneity when explaining industry level dynamics. Thus, not surprisingly, Klepper’s work naturally evolved into an in-depth examination of firms, and towards strategic management. Noting dissatisfaction with the “usefulness of models of industrial competition based on free entry” (Klepper & Simons, 2000; p 1015), given the inability of free entry

induced equilibrium to explain prolonged shakeout periods, Klepper merged his models of industry evolution with the strategic management focused question raised by Richard Nelson (1991), on “why do firms differ, and why does this matter?” Building off the core insight in Gort & Klepper that “outside” information possessed by entrants is critical in the industry’s early stages, Klepper proceeded to investigate an important source of entrant heterogeneity: their pre-entry experience in related industries.² In doing so, Klepper shifted the focus away from the classic entrant-incumbent dynamics in Schumpeterian creative destruction, to examining the hybrid case of the diversifying firm, which is both an established firm, and an entrant in the focal industry.

In the first of several papers examining firm level dynamics, Klepper & Simons (2000) explored heterogeneity among firms that entered in the television receiver industry, and examined the extent of entry, and the subsequent dominance by radio manufacturers. This paper is again written in Klepper’s hallmark style: motivation of the research question through empirical puzzles, followed by a formal modeling and derivation of propositions that may explain the observed patterns, and a testing of the theory by using painstakingly compiled novel datasets. The empirical puzzle is documented through the consistency of trends in the television receiver industry with the above industry evolution models, and also the observation of the heterogeneity of entrants in terms of both their timing of entry and subsequent performance. Klepper & Simons note that although radio producers were only a fifth of the entrants into television receivers, almost all of the top radio producers entered the industry, and these were the firms that dominated the market, in terms of both survival and market share. The motivation of the paper is then an attempt to understand this “dominance by birthright” of radio producers in the television receiver industry.

To do so, the Klepper (1996) model serves as a backdrop, with its main drivers of heterogeneity—differences in R&D productivity, and differences in timing of entry into the industry—being linked to the entrants’ prior experience. The experience in related industries, both

² Again, some of the ideas were anticipated in Cohen & Klepper (1992), as exemplified by the statement that “it is difficult for a firm to change deliberately its core expertise” (Cohen & Klepper, 1992, p. 781). At that point, Cohen & Klepper still assumed, however, that core expertise passed by a firm is assigned randomly.

from a technology and marketing/distribution perspective, is hypothesized as critical pre-existing capabilities that differentiate among the entrants. Accordingly, the five hypotheses in the model predict entry and performance differences in the television industry among radio and non radio manufacturers, and also relate them to within variation among radio producers based on their extent of experience and innovation capabilities.

While preceded by other studies that had examined the role of pre-entry experience (Carroll, et al., 1996; Mitchell, 1989; 1991) the Klepper-Simons study is nonetheless novel inasmuch as it systematically examines effects prior experience on firm entry and survival, but also brings home the implications for industry structure, by tying the capability level differences to industry growth and shakeout. As the first of several studies investigating firm dynamics within industry dynamics, it demonstrates another hallmark characteristic of Klepper's work: an attention to multiple levels of analysis by both digging deeper within firms to ascertain their capabilities, and by aggregating across them to discuss implications for more macro (industry and regional) levels.

In subsequent work, Klepper continued to develop models that simultaneously examined firm and industry level outcomes. Examining firm survival and the emergence of oligopolistic industries in Klepper (2002a), he built off his earlier theoretical models and undertook a detailed firm level analysis of four of the industries in the original Gort-Klepper data. Klepper (2000a) continued to focus on heterogeneity in firm capabilities and increasing returns to technological investments, but also added the expansion costs that may condition market selection as a critical ingredient of the model. Another feature distinguishing this paper from his prior work included the first explicit recognition by Klepper that pre-entry experience may also be manifested in new ventures through founders' knowledge. The model then related key features differentiating firms related to timing of entry, pre- and post-entry experience to firm survival, and resultant implications for the development of an oligopoly structure. The predictions of the model "work off two simple ideas: better to enter early than late, and better to be experienced" (p 41). In doing so, the questions addressed in Klepper (2000a) examined some fundamental interplays between firm strategy (conduct) and industry structure that were largely ignored in both the classic linear structure-

conduct-performance paradigm in industrial organization (Carlton & Perloff, 2004), and the strategic management literature that either focused on firm resources and capabilities (Barney, 1991), or on industry conditions (Porter, 1991) as determinants of performance.

Subsequent scholarly work examining firm dynamics in the context of industry evolution builds off Klepper's insights, and also points to a few unresolved puzzles. Some of the most important issues at the frontier of this research relate to the nature of capabilities represented by the different types of firms. Pre-entry experience endows firms with a "stock" of ability, whether technological capability or complementary assets (Mitchell, 1989; 1991; Tripsas, 1997), and impacts the manner in which they configure themselves for entry into the new industry (Qian, Agarwal & Hoetker, 2012). However, these may also affect their ability to reconfigure and adapt to the changing environment. On this latter point, Carroll & Hannan (2000) theorize that pre-entry experience of diversifying firms diminishes adaptability, while Chen, Williams & Agarwal (2012) show that diversifying firms are better at reconfiguration and surviving through growing pains, given their prior experience at reconfiguration and entering new markets. Research that digs down and discerns across the various capabilities that are impacted by pre-entry experience will help resolve these puzzles, and also better identify the sources of heterogeneity than mere dummy variables that distinguish among diversifying and *de-novo* firms. The analysis of firm dynamics also needs to be extended by broadening its perspective to include not only R&D and its escalation, but also "demand management" ability. In Klepper & Simons (2000), even though there is a recognition that home radio manufacturers also had access to distribution channels and consumer knowledge, it is not explicitly modeled. Market insights, however, appear to be a universally important determinant of firm dynamics (e.g., Franco et al., 2009).

Another relatively understudied area is the "pre-production," or tinkering stage (Carroll & Hannan, 2000; Franke & Shah, 2003; Jovanovic, 2004; Moeen & Agarwal, 2014). While Apple, Microsoft and Google have brought "garage tinkering" to public attention, such tinkering was present in almost all new industries since the dawn of the Industrial Revolution, including the automobile and other industries studied by Klepper (see, e.g., Carroll & Hannan, 2000). This "Stage

0” of the industry life-cycle, also called the incubation period (Moeen & Agarwal, 2014), may itself be composed of mini-stages closely resembling the post commercialization stages documented in Gort & Klepper (1982)—first, there are just a few tinkerers or firms investing in the technology; then “tinkering” or technological investments spreads, encompassing whole communities; eventually leading to a “shakeout,” followed by the emergence of the industry due to the first few firms that commercialize their prototype products (Franke & Shah, 2003; Jovanovic, 2004; Moeen & Agarwal, 2014). Most interestingly, much of the “shakeout” in the pre-production stage happens through alliances and acquisitions (Moeen & Agarwal, 2014), which seem to represent a way for firms lacking internal capabilities to access such capabilities externally.

EMPLOYEE ENTREPRENEURSHIP

An In-depth Examination of the Phenomenon

Q “How did you get interested in employee entrepreneurship?”

A “I had long been looking at the laser industry trying to understand why for roughly 30 years of its existence it had not gone through a shakeout. My whole theory of shakeouts hinged on technological change by what you may call today an R&D escalation process. I couldn’t understand why after 30 years we couldn’t see something comparable in lasers, so I hired a student, Sally Sleeper, to research this question. and I got a theory. My theory was that there were constantly new kinds of lasers being created and each one provided an opportunity for new kinds of producers to enter the industry. To research this, I said to Sally, I am really articulating a theory that says, firms have capabilities when they begin, when they are born, new firms. You want to test that theory, you are interested in exploring that theory. You could do that as your thesis—she had started out being interested in government policy in the lasers. As she started pursuing that, she asked me: when classifying firms, how do I classify firms that had been founded by employees of other laser companies? and that’s when I started asking questions about this so-called spinoff process. Are these good firms? Where do they come from—do they come out of the best firms in the industry? and, remarkably, they turned out to be the best firms in the industry and they came out of the best firms, which I found to be absolutely fascinating—the best firms were found to be generating the next round of spinoffs!”

Klepper’s above answer succinctly summarizes another hallmark characteristic of his approach to scholarly research. Not only did he make the study of evolution (of industries, firms, and later regions) his life-long passion, he built on his prior knowledge base through his intellectually curiosity. The mainstay focus on synergies between theory and empirics, induction and deduction, enabled his constant evolution. Most of this intellectual evolution was triggered by him discovering

(or becoming aware of previously discovered) new empirical facts and regularities. Klepper strongly believed in building theory, by which he meant developing a rigorous logical model starting from some primitive assumptions and delivering the empirical patterns in the data. That was the process, already described above, by which he developed the model in Klepper (1996) designed to provide a coherent and parsimonious explanation for the evidence underlying Gort & Klepper (1982). At the same time, Klepper never stopped looking for new and interesting empirical patterns, especially when they did not fit his existing theoretical constructions. One should not be surprised, therefore, that he would spend a lot of time “looking at the laser industry,” which presented an apparent puzzle from his perspective, given that it had avoided a shakeout for 30 years. While the industry eventually conformed to the predicted pattern of shakeout due to one type of solid-state lasers—diode-pumped solid state laser (DPSS)—breaking through barriers separating seemingly unrelated submarkets (see Bhaskarabhatla & Klepper, 2013), the in-depth examination motivated Klepper to develop several new research areas that contribute to his legacy today, almost as much as his study of industry evolution.

While Klepper’s answer clearly depicts that his interest in employee entrepreneurship was an outgrowth of his interest in industry evolution, the insights gained from analyzing submarkets and employee entrepreneurship quickly led to the development of a separate burgeoning area of research. Building off Gort & Klepper (1982), he had already established in Klepper (1996) and Klepper & Simons (2000) that the importance of “inside information” in industry evolution and firm survival manifested through the pre- and post-entry experience of established firms. An in-depth examination of the laser industry in Klepper & Sleeper (2005) showed that even new ventures may have access to inside information. Through employees who turn founders, spinoffs (or spinouts) represent a distinct category of *de novo* entrants, and Klepper subsequently devoted significant effort at uncovering factors that impacted their entry and post-entry performance.

In Klepper & Sleeper (2005), an extensive and detailed hand-collected data set (as always!) on the laser industry is used to systematically examine various regularities related to spinoffs making use of capabilities and “inside information” gained while at their parent firms, and also to investigate

parent firm characteristics that result in differences in rates of spawning. For example, Klepper & Sleeper (2005) established that product-specific and not general experience at the parent was a key for spawning a spinoff and that the “middle age” was the most fertile period for firms to spawn spinoffs. They also noted where the analysis yielded inconsistencies with their theory, inasmuch as entry by spinoffs did not seem to result in a negative impact on their parents in the laser industry.

Noteworthy in this context is Klepper’s comprehensive approach to research. Realizing that other scholars had examined the phenomenon across other industry contexts in published and ongoing research (Agarwal et al., 2004; Bhide, 2000; Brittain & Freeman, 1986; Chesbrough, 1999; Franco & Filson, 2006, first working paper version 2000; Garvin, 1983), Klepper sought to gain a complete understanding of the landscape by undertaking a thorough literature review of both empirical and theoretical perspectives. The benefits of this “taking-stock” exercise were shared with other scholars in Klepper (2001), even as Klepper continued to develop his own theoretical model and empirical analysis in Klepper & Sleeper (2005). Simultaneously, Klepper re-examined his previously collected data on the automobile industry, and in Klepper (2002b), he depicted the specific novel organizational challenges faced by new industries, which makes working for an incumbent firm “the best place to learn how to address those challenges.” (p. 646) Thus, founders’ background, in which they learn from experience in the best firms in the industries³, gives spinoffs distinct advantages, even relative to diversifying firms from related industries, who he had previously claimed had a “dominance by birthright” (Klepper & Simons, 2000).

Klepper & Sleeper (2005) is a significant milestone in Klepper’s own intellectual evolution, as it marks his first attempt to go beyond the theory in Klepper (1996). By this time, other scholarly work had made it apparent that many industries did not fully conform to his previous theory. The industry evolution literature itself had evolved due to blossoming scholarly attention over two decades, establishing a key stylized fact regarding the development of submarkets that built off

³ Boeker & Fleming (2010) find that founders coming from better parents are less likely to be replaced by “professional managers,” and this effect is stronger when the startups use more uncertain technologies.

technological discontinuities (Christensen, 1997; King & Tucci, 2002; Mitchell, 1989; 1991). These technological discontinuities triggered renewed entry (Mitchell, 1989; King & Tucci, 2002; Sarangee & Echambadi, 2013) and multiple opportunities for firms to pioneer new segments by building off capabilities developed in earlier markets (Franco et al., 2009). The ensuing incumbent-entrant dynamics led to more complicated industry evolution patterns than shakeouts followed by an oligopolistic market structure, which Gort & Klepper (1982) did not document, and Klepper (1996) could not fully explain.

The model in Klepper & Sleeper (2005) works off the concept of differentiated products, with each variety produced by a separate firm targeting customer needs specific to that submarket. At some point, a new variety is developed within a given firm, which can generate more profit than the existing variety. The firm which developed the idea, however, may not want to introduce the new variety, given concerns of cannibalization of the existing submarkets. This makes entry by spinoffs profitable, even though entry by incumbents is not. Of course, the incumbent firm may be forced, in spite of lower payoffs, to enter the new submarket in order to preempt entry by spinoffs. To address this issue, Klepper added a non-zero probability that the incumbent firm simply does not recognize the opportunity, and also that the incumbent attaches a probability to spinoff entry.

The theoretical construction above is somewhat awkward, with the probability of the parent firm not recognizing the opportunity and its subjective probability assessment of how likely the spinoff is to enter the market having no obvious connection to the rest of the model. Moreover, while in the model, spinoffs replace their parents by producing superior product varieties in the same market segment, in the reality of the laser industry, spinoffs “generally did not compromise the viability of their parents’ related markets” (p. 1303). Even more disturbing to Klepper was the fact that in the Klepper-Sleeper framework, entry by spinoffs may be “not necessarily socially productive” (p. 1305). Not only was this conclusion, forced upon Klepper by his model’s logic, at odds with the facts of the laser industry, it also ran contrary to his general intuition that spinoffs were in fact quite productive from a social perspective (the view he subscribed much more forcefully later on, as discussed later). In Klepper & Sleeper (2005) the issue is relegated to the concluding

discussion section, where, in their own admission, they “speculate” that spinoffs may be socially productive, after all, because they bring diversity, a decline of which in an otherwise inevitable oligopolistic market structure “can retard an industry’s rate of technological change” (*ibid.*). This issue (the role of diversity in industry vitality and keeping the pace of innovation and technological change) still largely remains unexplored and represents, in our view, one of the most promising lines of research opened up by Klepper’s work.

Klepper himself never used the differentiated product approach again. Instead, in his subsequent work (conducted jointly with Peter Thompson who arrived at Carnegie Mellon in 2002), he developed a model of industry evolution through creation (and destruction) of submarkets (Klepper & Thompson, 2006). In this theory, technological opportunities present themselves randomly to both existing firms and potential entrants, and generate random returns. New submarkets do not compete for customers with old submarkets at all; instead, old submarkets are assumed to be exogenously destroyed, also through a random process. The model is remarkable in that it delivers, in a mathematically rigorous and transparent way, empirical predictions that are consistent with almost all known stylized facts about the evolution of firms with age in terms of size, growth and survival, as well as other distinct facts about the evolution of industries and firms. Yet, there is not a single economic decision made by any agent—markets, firms and industry structure all evolve according to a simple mechanical Brownian motion! According to both Klepper and Thompson, the first time they presented the paper, they were yelled at by members of the audience. Further, a referee in a leading journal rejected the paper in a scathing review, accusing the authors of “setting economics back 50 years.” Nevertheless, the idea of an industry’s continued growth fueled through entry that creates new independent submarkets appealed to Klepper, and he relied on it in much of his subsequent work, especially on regional agglomeration.

Towards a Theory of Spin-offs: Strategic Disagreements and Returns to entrepreneurship

Q “Your recent work on employee entrepreneurship focuses on strategic disagreements and cognitive differences. Does psychology have anything to do with it?”

A “I don’t know. Those concepts just came out naturally of the empirical phenomena that I was studying. Just digging in and really trying to understand why employees left and

founded their own firms. Disagreements just seemed to come up over and over again. Is that psychology? Economics is filled with psychology. I wouldn't single that out as something special for psychology in economics. Just another aspect of the empirical phenomena.”

Within neoclassical economics, employee mobility or entrepreneurship is typically conceived as a problem of incomplete contracts, with a corresponding loss of efficiency relative to the optimum case of complete contracts (Acemoglu & Pischke, 1998; Anton & Yao, 1995; Hellman, 2007; Pakes & Nitzan, 1983). The framework in Klepper & Sleeper (2005) is consistent with this paradigm, though they do not invoke contracting explicitly. However, Klepper's empirical observations—much of the impetus for which came from the interviews his Ph.D. student Jeff Sherer was conducting with founders of laser firms at the time—led him to believe that factors most important to spawning may be elsewhere. He noticed that the impetus for employee entrepreneurship was highest when incumbent firms, for whatever reasons, *chose not to pursue* the innovative ideas proposed by their talented employees, leaving the latter no option to see their idea being brought to fruition within the parent firm. Incumbent firms, especially the leading ones, thus trained the next round of entrepreneurs who propelled their industries forward, but they did so without realizing *what* they were doing. The issue thus is not one of expropriation hazards caused by incomplete contracts, but that of differences in perceptions of value creation, or *strategic disagreements*.

The glimpse of this idea is first seen in Klepper & Sleeper (2005), where they note a “common finding” about employee startups, that “employees leave to start their own firms after becoming frustrated with their employer.” This frustration is often related to a new idea about an innovation or a submarket to explore being rejected by the employer (Klepper & Sleeper, 2005, p. 1292, citing Garvin, 1983). Klepper further developed this insight in collaboration with Peter Thompson, through a new, mathematically rigorous theory of entry by spinoffs caused by disagreements (Klepper & Thompson, 2010). In their model, firms are founded by individuals sharing a common prior belief about the right strategy for the firm. This prior belief is not necessarily correct, however (more precisely, it is *incorrect* with probability one). As the firm starts operating, founding team members receive noisy signals about the right strategy, and apply Bayesian

updating rules to “drift” from their initial prior belief to the optimal strategy point, converging to the latter as time goes to infinity. It is assumed that although prior beliefs are the same, one member of the team has more precise signals, and is able to adjust his posterior beliefs toward the optimal strategy faster than other members. A disagreement results, which may lead to the founder with less noisy signals to split off from the rest of the team to found his own firm (a spinoff). Remarkably, the model delivers most of the important and heretofore unexplained empirical patterns uncovered in Klepper & Sleeper (2005) and other studies—for instance, it follows from the model’s logic that the “middle age” is the period when most spinoffs are spawned (because when the firm is young, the common prior shared by all founders dominates, while as the firm grows very old, all founders find themselves in agreement once again, since Bayesian updating leads them to converge to the optimal strategy choice regardless of noise). The close positioning of the spinoffs and their parents in the product (strategy) space, the relationship between better performance of the parent firm and the spinoff (and the fact that spinoffs tend to be even better than parent firms) are other real-world phenomena which are neatly predicted by this model (see also Thompson & Chen, 2011). Developing this theory further, by adding an element of non-trivial diversity (and not just different degree of noise around the same “true” optimal strategy), was the task that had occupied Klepper’s mind until the very end, and which he pursued in his last completed paper, joint with Russell Golman (Golman & Klepper, 2013), discussed in the next section.

The study of factors that impact entrepreneurial spawning has certainly blossomed in the last two decades, and remains an area that can benefit from additional scholarly attention. Complementing research that focuses on contractual relationships and property rights, scholars have examined the effects of institutional factors such as non-compete clauses (Garmaise, 2011; Gilson, 1999; Marx, Strumsky & Fleming, 2009; Samila & Sorenson, 2011) and patent enforcement (Agarwal, Ganco & Ziedonis, 2009; Ganco, Ziedonis & Agarwal, 2013) on employee mobility and entrepreneurship; the greater the ability or willingness of the parent firm to utilize these institutional levers, the lower is the incidence of employee departure. At the organizational level, complementing

Klepper's focus on strategic disagreements, Agarwal et al (2004) find that underutilized knowledge, rather than abundant knowledge per se results in higher rates of entrepreneurial spawning.

In addition to antecedents of entrepreneurial spawning, an important area of research relates to the performance consequences, for both the parent and the spinoff firm. Most of the extant work finds that spinoffs have higher performance relative to other startups (Agarwal et al., 2004; Franco & Filson, 2006; Klepper & Sleeper, 2005; Phillips, 2002), but that knowledge spillovers through employee turned founders adversely impacts parent performance (Campbell, et al., 2012; Phillips, 2002; Wezel, Cattani & Pennings, 2006). However, Agarwal, Audretsch & Sarkar (2007) discuss the possibility that parents can benefit through "spill-ins" of knowledge from spinoffs. This conjecture is worthy of additional scholarly attention, particularly when spinoffs occupy complementary or upstream/downstream positions in the value chain (Malerba, Adams & Fontana, 2013).

While the first set of questions in Klepper's work on employee entrepreneurship focused on factors that impacted entrepreneurial spawning from incumbent firms, another issue that fascinated Klepper was the returns to entrepreneurship, especially the innovative, "Schumpeterian"-type entrepreneurship and the role played in this process by the interaction of pre-entry experience and individual ability. This was also motivated by an empirical puzzle: while the evidence from research on employee entrepreneurship clearly showed that startups, especially in high-tech industries, were founded by talented individuals, and also enjoyed superior performance, evidence using broad data sets where entrepreneurs are dominated by self-employed individuals and startups are formed in low and high growth industries showed negative pecuniary returns to entrepreneurship, or bi-modal patterns at best (Evans & Leighton, 1989; Hamilton, 2000; Åstebro et al., 2011). An opportunity to look at important, Schumpeterian-type entrepreneurial startups in a large data set that could be used for econometric analysis presented itself to Klepper with an NSF data set on the U.S. scientists and engineering workforce. The initial suggestion to employ this data set for the purpose of studying Schumpeterian entrepreneurship came from Michael Gort while Braguinsky and Ohyama were based in SUNY Buffalo. Klepper joined the project in 2008, after Braguinsky arrived in Carnegie Mellon

The paper on high-tech (Schumpeterian) entrepreneurship (Braguinsky, Klepper, & Ohyama, 2012) starts with a theoretical model, where workers are presented with ideas for venturing out, and these ideas are initially of unknown quality. Pre-entry labor market experience helps individuals to better discern the quality of the ideas for the startups, but the economic returns to a startup (conditional on the quality of the idea) exhibit increasing returns in innate ability of the entrepreneur. The model implies that older and more experienced individuals are more likely to form startups, but that conditional on survival, startups founded by younger (less experienced) entrepreneurs will produce even higher economic returns, as increasing returns to ability motivate exceptionally talented individuals to start their own ventures despite high underlying uncertainty about idea quality. Thus, entrepreneurial earnings, while increasing in tenure of running a business, as consistent with extant entrepreneurship research, are also *decreasing* in the age (labor market experience as a worker) of their founders, a novel model implication that had neither been examined nor observed in extant empirical studies.

Both theoretical predictions above are consistent with the NSF data. The relationship between age, pre-entry experience and entrepreneurial (or managerial) success discovered in Braguinsky et al. (2012) suggests that more studies could be fruitfully conducted into the relationship between individual ability, age, and the pace of technological change (see for example, Acemoglu et al., 2013). The individual level of analysis remains an important area of research, as does examining similarities and differences in factors that cause employee mobility vs. entrepreneurship. Some scholarly attention has been devoted to this issue more recently (Campbell et al, 2012; Carnahan et al., 2012; Ganco, 2013). In particular, Ganco (2013) shows that individuals working on inventions with greater technological interdependencies are more likely to create new ventures on their own, and the effect of technological interdependence on start-up formation is even more pronounced for entrepreneurial teams. Presumably, higher-ability individuals work on more complex problems, and Agarwal et al. (2013) show that higher-performing individuals are more likely to assemble larger entrepreneurial teams, and teams with greater tenure, factors which increase returns to entrepreneurship. It also appears that higher performers are less mobile, but conditional on mobility,

more likely to create new ventures (Campbell et al., 2012), particularly if parent firms have more equitable compensations structures (Carnahan et al., 2012).

Klepper also emphasized cognitive differences, and perhaps even non-pecuniary incentives (i.e. frustration), but his answer above indicates that he was not sure about the relevance of psychology as a lens in examining the phenomenon. This open question suggests another avenue of future research, particularly in light of recent evidence that there are distinct differences in psychological motives among individuals who are “stayers” in established firms, “founders” and “joiners” of startups (Sauermann & Roach, 2013).

FROM FIRM HERITAGE TO GEOGRAPHICAL CLUSTERS: THE EVOLUTION OF REGIONS

Q “Your work spans across multiple levels of analysis: regions, industries, firms and individuals. Is there one level that is more critical than others, in your opinion?”

A “I would not say more critical, but [the study of] regions encompasses everything, so it encompasses most economic mechanisms. So I think regions are where I have laid most emphasis. ... it is explaining why there is geographic concentration of activity within regions. ... That’s the important part and what ultimately does this imply for policy. ... I still think geography is the most under-researched area. All these beliefs that have come about, I don’t think they are well-founded, so I think there are great opportunities there.”

As evident from Klepper’s answer, he himself considered his most recent work on agglomeration and regions (unfortunately cut short by his untimely death) as encompassing all his previous work, and yet another challenge to the standard economic theory. The “not-so-well-founded beliefs” about agglomeration economies Klepper refers to above, dating back to Alfred Marshall (1890, ch. 10), are not only held by economists (see, e.g., Krugman, 1991), but also widely adopted in strategy (e.g. Alcacer & Chung, 2007; Shaver & Flyer, 2000). Agglomeration research emphasizes that pooling of labor and other resources, combined with “spillovers” of knowledge create externalities, thus conferring advantages on firms who chose to locate within clusters (Saxenian, 1991). Through his in-depth study of industry evolution and employee entrepreneurship, Klepper became convinced that the causal process was reversed. Examining successful industrial clusters, be they automobiles in Detroit, tires in Akron, or semiconductors in Silicon Valley, he noted that geographic clusters arose due to the superior heritage of spinoffs—better firms were

spawned from better parents, and these spawns chose to remain local. Klepper's final area of research, focusing on geography and regions, thus was the logical evolutionary transition stemming from his study of employee entrepreneurship, which itself was a by-product of his life-time interest in the phenomena of industry evolution. Most of his last papers (including several yet to be published, such as Carias & Klepper, 2013; Golman & Klepper, 2013) are dedicated to these issues, and they certainly preoccupied his mind right until the very end. Thus, we see yet again the same evolutionary pattern in Klepper's research: a synergy between the "old" and the "new," and an integrated approach to research that permitted him to build on his prior expertise, but continue to evolve in new directions.

The first study explicitly focusing on industry clustering as a consequence of organizational reproduction and heredity rather than any agglomeration economies (Buenstorf & Klepper, 2009), was contemplated and conducted, once again, in Klepper's hallmark style where very detailed and meticulous data collection and processing preceded everything else. As Klepper recalled in a private conversation, he had not realized for a very long time the proximity of Akron to Pittsburgh. This "localization," ironically, enabled him to conduct frequent deep dives into the archives, to examine the backgrounds of founders of various (long defunct) Akron tire producers.

The key idea of the heritage theory of clustering is that a region's "birth potential" (Carlton, 1979) "is shaped by an endogenous process that gives rise to a build-up over time of superior firms around successful early entrants" (Buenstorf & Klepper, 2009, p. 717). The initial leading firm (or a few firms) locate in a given region randomly, by pure chance.⁴ Spinoffs from these firms inherit the higher competence of their parents, and choose to locate in the vicinity. Over time, they snowball to create a cluster that comes to dominate other regions that lacked the resultant concentration of firms with high competence. A subtle, but nevertheless crucial, distinction with agglomeration theory is that just having a high concentration of firms in a given area does not generate any additional

⁴ One of Klepper's favorite anecdotes in this regard was the birth of Silicon Valley's semiconductor industry through the heritage process started by William Shockley choosing Palo Alto for his startup, because his mother happened to live there.

benefits to new firms locating in the cluster, so that a random firm locating in a cluster should not have any significantly better outcome than a random firm locating elsewhere; all the perceived benefits of clustering are in fact benefits that stem from firm heritage (the quality of its parent).

Klepper was thus able to tie his theory of entry by spinoffs to industry clusters and regional development. With careful econometric analysis at the county level, Buenstorf-Klepper confirmed that it was the backgrounds of founders and not mere choice of location that determined the success (or lack thereof) of entrants in the Ohio tire industry. Curiously, Guido Buenstorf recalls how he became a member of the project by pure chance as well—he had just arrived in Pittsburgh to seek Klepper’s insights on his own work on the laser industry. Klepper, singularly focused on his new project, invited him to drive to Akron together instead. According to Klepper, Buenstorf’s work with the Akron archives was absolutely invaluable for their subsequent joint research.

The findings in Buenstorf & Klepper (2009) were further reinforced by Berchicci, King & Tucci (2011); founders of spinoffs in disk drives that had more aggressive strategies perceived a greater need to maintain local relationships. Klepper subsequently extended this analysis to challenge another neoclassical paradigm, according to which ideas “float in the air,” generating positive externalities and contributing to success of industrial clusters. A recent paper in a similar vein but on the semiconductor industry (Cheyre, Klepper, & Veloso, 2013) documents that most of the success of the Silicon Valley firms can be attributed to heritage and tacit knowledge transfer, leaving little unexplained variation between it and other regions. and in another recent paper (Carias & Klepper, 2013), Klepper used matched employer-employee dataset from Portugal to establish that pooling of labor resources may also be caused not so much by general external effects available to all firms in clusters, but by a targeted mechanism through which founders of new firms hire their former colleagues for the superior knowledge that those possess.

The project with Russell Golman (Golman & Klepper, 2013), Klepper’s last completed work, was also one that generated the most excitement in Klepper during the last months of his life. In this paper, Klepper returned to the issue of entry by spinoffs, aiming to create an even more transparent tie between the ideas of submarkets and firm heritage than in his previous work. In the

model, firms grow by discovering new submarkets through innovation (similar to Klepper & Thompson, 2006), but new submarkets are now not completely independent of previous submarkets that the firm operates in. Instead, each submarket is characterized by a bunch of product characteristics, and each time a new characteristic is added to the set of existing ones, a new submarket is born. Because innovations are combined with existing submarkets, “a firm’s innovative capabilities evolve as the firm gains experience in more submarkets” in a variant of organizational learning (p. 11). As in Klepper & Sleeper (2005), there is a given probability that an incumbent firm may fail to enter a newly discovered submarket, which gives employees who contributed to the innovation a chance to leave their old firm and form a spinoff. The spinoff becomes a new, independent innovating entity. Initially, the spinoff and the parent are very similar (their submarkets differ by only one characteristic, although the parent firm may be also be operating in other submarkets), but as a spinoff engages in its own innovations independently of the parent firm, the two become more and more differentiated over time, consistent with the diversity argument heuristically advanced in Klepper & Sleeper (2005).

But perhaps the most important novel feature in Golman & Klepper (2013) is that the model implies a strong complementary relationship between higher innovativeness of the industry and the degree of clustering, happening because “more innovative industries provide more opportunities for spinoffs to form, and it is (only) spinoffs that give rise to clustering” (p. 16). One key insight from this, which Klepper himself chose to emphasize in a short policy-oriented piece (Braguinsky & Klepper, 2009), is that “we need to reassess the trade-off between vested interests of incumbent firms and the broad social need for sustained economic growth. Incumbent firms have long argued that when their employees leave to start their own firms they inevitably exploit their hard-earned intellectual property, which in the long run will stifle their incentives to innovate. Detailed examination of employee startups in a diverse set of industries and regions, however, reveals a very different picture. The most successful employee startups ... were motivated mainly by the unwillingness of their employers to aggressively pursue promising new ideas. We seem to be

witnessing a limit on what existing organizations can do and the spectacular growth that can be unleashed when employees pick up the mantle and run with it” (p. 30).

REFLECTIONS ON THE EVOLUTION OF A SCHOLARLY CAREER

In this final section, we dwell on some salient milestones in Klepper’s scholarly career, incorporating his own reflections on the interplay between his conscious choices and the professional path dependencies, and his advice to a future generation of scholars.

It might come as a surprise to those who know only Klepper as a scholar of industry evolution, entrepreneurship and economic geography, that he started his career as a theoretical econometrician, and was granted tenure at Carnegie Mellon largely based on two theoretical articles on errors-in-variables published in *Econometrica* (Garber & Klepper, 1980; Klepper & Leamer, 1984), along with three other econometrics-focused articles. As he recalled in his interview, “I had a separate career as an econometric theorist, and that was essential for providing me with certain credentials that I exploited very productively. People tend to forget about it because it was so early in my career. But, I would say, that was surprisingly important. It freed me up to do all the work I did on industry evolution. ... It enabled me to get tenured. and once I got tenured, I decided that I was not a theoretical econometrician, and I really needed to focus on what I thought my skills were, where my skills lay best. and that was more industry evolution. I am glad I made that decision. So pretty much after that, after the mid-1980s, all I did was work on industry evolution.”

This first switch in research focus was one of conscious choice, both leveraging the skills he had acquired, and building on his astute understanding of where his true skills and passions resided. The second “switch” was more subtle and gradual—and related to the increasing focus on strategy, entrepreneurship and technological change (SETChange, as the unique Carnegie Mellon Ph.D. program Steven founded is called), while continuing to “productively exploit” his disciplinary lens from industrial economics. Klepper was loathe to develop pure abstract theories and always grounded his theorizing firmly in important real-world phenomena, even if it meant challenging the accepted modeling “orthodoxy,” and he especially detested what he called “technicalities without ideas.” Paraphrasing Sid Winter, Klepper noted a feeling that he did not quite belong in economics

circles—going to economics conferences meant that he had to “take off one head, and put on another.”

Spurred by this “disagreement,” Klepper spun off, and focused on developing the budding field of evolutionary economics. He found a few kindred spirits among fellow economists, for example, Sid Winter and Dick Nelson had been simultaneously working on evolutionary economics with a focus on the firm as a unit of analysis (Nelson & Winter, 1982). When Dick Nelson suggested that residual funds from a Sloan Foundation grant may be optimally utilized to develop graduate students in an annual conference through constructive feedback from the few, geographically dispersed scholars who had broken tradition, the virtual cluster of the Consortium for Competitiveness and Collaboration (CCC) was born. In line with Klepper’s “heritage theory of spinoffs,” those scholars spawned a vibrant community (albeit through conscious deliberation, rather than through inadvertent or strategic disagreement). Over the last 20 years, successive generations of graduate students now represent thought leaders in strategic management, innovation, and entrepreneurship across leading business schools.

The CCC community represented Klepper’s intellectual home base, and his deep commitment to the “cause” was evident in his willingness to “incessantly beg” for funds from other senior scholars, during the fallow years with no grant support. The story” of CCC is a truly remarkable testimony to the dedication of faculty advisors, not only to the development of their own graduate students, but to the evolution of a community. Many of the “founding” and early faculty attendees generously gave out of their own research budgets to pay for the consortium related expenses when the Sloan Foundation grant expired. Today, the annual CCC conference is funded in part through the Kauffman Foundation, given their focus on talent development, and in part by the host institutions, where alumni of CCC “pay it forward” by providing invaluable time, effort and funds.

Klepper’s willingness to spearhead the CCC also arose from his aspirations for the community, largely based in strategy, who he believed would continue to pick up the gauntlet of:

“empirical ideas which are really worth developing because they challenge in many respects some of the key frameworks of neoclassical economics. In strategy, people will find empirical evidence that I think when examined rigorously is going to challenge the orthodoxy....Strategy’s priority is empirical first, theorizing second. Not that there is a tradeoff between the two, so I think it’s definitely something strategy people will keep pursuing and they will naturally try to answer some of these questions theoretically, and as they do, they will make headway in key questions.”

The comment above emphasizes once again a cornerstone aspect of his research methodology. The formative influence of meticulously shuffling through trade journals with Michael Gort, and recording data on producers, major and minor innovations by hand, had prompted Klepper to move from being a pure econometric theorist to a scholar who wanted to get right the “facts first.” Not only was he no longer satisfied with just doing abstract theory, he also developed a strong preference for slowly building his own data sets by hand, starting from primary sources and archival work whenever possible. While the costs of such an approach were considerable—building a data set on just one industry often took 3-5 years—they were offset by a true understanding of the phenomena, which enabled richer and deeper theory development than afforded through the use of statistical analysis of canned datasets in search of “statistically significant” results. As evidenced by the above review of his scholarly work, it also allowed Klepper to evolve and grow as a scholar himself, and provide foundational insights across multiple research areas. In this context, the following excerpt from the interview is particularly revealing:

Q: “You have often mentioned that you kept asking yourself the question of why you were successful where others were not, and you said you concluded that it was not any special talent or any super-ability, but just perseverance and hard work. Is this right?”

A: “Yes, I think that is absolutely correct. Whenever I smelled an opportunity, I tried to jump on it and do even more intensive empirical work and that paid off for me.”

Klepper’s entrepreneurial spirit is further reflected by his belief that one needs to chart one’s own course, using self-reflection, and propelled by the intrinsic motivation of undertaking scholarship rather than the extrinsic focus on quantity and quality of publications. To this point, we offer, in his own words, the wisdom he leaves behind for the future generation of scholars:

Q: “What kind of advice do you have for young scholars? That is, if you were advising a junior faculty member or a Ph.D. student, what areas would you suggest they should particularly focus on?”

A: “I am a big believer that you’ve got to pursue something that you think is really important and that’s what should guide your work. You’ve got to think that you are doing

the next revolutionary thing until you get right there at the end of finishing it. Then, you have to take a more sobering look at what you have done, so that you are at least self-critical. But I think you have to just pursue what you find to be fascinating, so forget about how many journal A papers do I have, how many journal B papers... I hate that kind of thinking, I think that's the absolutely worst way to go. You should look at the phenomena and write a series of papers to explore the phenomena."

Q: "But you yourself earlier said you first got tenured through your work on theoretical econometrics and that freed you to work on industry evolution. So count journal A publications until you get tenured and then forget all about it, right?"

A: "[Laughs] I didn't count it even then. I was just focusing on this issue of errors in variables, that's what I did."

Q: "So, what theories, methodologies, tools and techniques should they master to begin with?"

A: "I wouldn't prescribe anything in that respect. Learn and master what you need to master to do your research. That's as far as I would go."

CONCLUDING THOUGHTS

In part reflecting our own heritage and deep influence of both Michael Gort and Steven Klepper, we believe that the future of both economic and strategy scholarship lies in the "Gort & Klepper" blend of theory with in-depth data work, where theories are motivated by important real-world phenomena, and where econometric analysis is rooted in rigorous theory and conducted with full understanding of the context and potential economic impact of the relationships. Klepper himself liked the name "nanoeconomics" for this approach, which he defined as "digging beneath the surface of markets to understand the forces that drive their formation and functioning," (Klepper, 2013b).

With his illustrious career cut short, Klepper could only leave us detailed "nanoeconomic" analyses of six industries, all of them in the U.S; penicillin, automobiles, tires, radio and TV receivers, lasers, and semiconductors. During the last months of his life, even as his body battled cancer, his mind forged ahead in a determined effort to complete as much of his ongoing projects as he could. Indeed, he leaves behind him a legacy, and a true wealth of insights related to innovation and entrepreneurship that were unlikely to have been generated by any other approach. Comments

by Sid Winter and Dick Nelson to the co-authors provide apropos and concise summary statements of Steven Klepper's contributions, so we simply repeat them here, without embellishment.

Sid Winter: "I think that the two most important things I have learned about "capitalism" since I was in graduate school both have Steve's name on them – the first being the industry evolution story, and the body of systematic empiricism on that, and the second being the achievement on the spinoff story. If you want two examples of very important things about capitalism that never get in the heads of economics graduate students, those are my leading candidates."

Dick Nelson: "While he seemed reluctant to take on that designation, I always considered Steve as among the very top scholars doing evolutionary economics, broadly defined, whose work showed vividly the value of the general orientation. In my view, the hallmarks of that orientation are: that the economic world must be understood as always in the process of changing and often far from any equilibrium; with innovation the principal driving force; an understanding that economic actors operating in such a context almost inevitably are going to be doing different things in their efforts to do well or even to survive; and that there are selection forces that winnow on that variety which by doing so set the stage for the next stage in the dynamic process. I think this point of view is there in almost all of Steve's work, and also a methodological perspective that economics is basically about empirical phenomena and that theory should not blind one to what is going on."

Klepper himself embodied innovation and entrepreneurship, and while he is sorely missed today, we end not on a note of sadness, but one of energized hope. Given the number of intellectual "spinoffs" influenced by Klepper over the years (and spinoffs of those spinoffs who are coming of age), the collective effort of a vibrant scholarly "cluster" will surely generate an accelerated growth in the evolution of his ideas, enriching our understanding of firms, markets and industry co-evolution, and generating a significant number of important management and policy implications.

REFERENCES

- Acemoglu, Daron, Ufuk Akcigit, & Murat Alp Celik, 2013. "Young, Restless, and Creative: Openness to Disruption and Creative Innovations," Working paper, MIT and University of Pennsylvania.
- Acemoglu, Daron, & Jörn-Steffen Pischke, 1998. "Why Do Firms Train? Theory and Evidence," *Quarterly Journal of Economics*, 113 (1), 79-119.
- Agarwal, Rajshree, 1998. "Evolutionary Trends of Industry Variables." *International Journal of Industrial Organization*, 16 (4), 511-525.
- Agarwal, Rajshree, & Sonali K. Shah, 2013. "Knowledge Sources of Entrepreneurship: Firm Formation by Academic, User and Employee Innovators," Working paper, University of Maryland.
- Agarwal, Rajshree, Benjamin A. Campbell, April M. Franco, & Martin Ganco, 2013. "Who Do I Take With Me?: The Mediating Effect of Spin-Out Team Size and Tenure on the Founder-Firm Performance Relationship," US Census Bureau Center for Economic Studies Paper No. CES-WP-13-17.
- Agarwal, Rajshree, Martin Ganco, & Rosemarie H. Ziedonis, 2009. "Reputations for Toughness in Patent Enforcement: Implications for Knowledge Spillovers via Inventor Mobility," *Strategic Management Journal*, 30 (13), 1349-1374.
- Agarwal, Rajshree, & Mary Tripsas, 2008. "Technology and Industry Evolution," in Scott Shane, ed., *The Handbook of Technology and Innovation Management*, John Wiley & Sons, West Sussex, England, 3-56.
- Agarwal, R., Audretsch, D. and Sarkar, M. B. (2007), The process of creative construction: knowledge spillovers, entrepreneurship, and economic growth. *Strategic Entrepreneurship Journal*, 1: 263–286
- Agarwal, Rajshree, Raj Echambadi, April M. Franco, & MB Sarkar, 2004. "Knowledge Transfer Through Inheritance: Spin-out Generation, Development, and Survival," *Academy of Management Journal*, 47 (4), 501-522.
- Agarwal, Rajshree, & Barry L. Bayus, 2002. "The Market Evolution and Sales Takeoff of Product Innovations," *Management Science*, 48 (8), 1024-1041.
- Alcácer Juan & Wilbur Chung, 2007. Location strategy and knowledge spillovers. *Management Science* 53(5), 760–776

- Anton, James J, & Dennis Yao, 1995. "Start-ups, Spin-offs, and Internal Projects," *Journal of Law, Economics, and Organization*, 11 (2), 362-378.
- Åstebro, Tom, Jing Chen, & Peter Thompson, 2011. "Stars and Misfits: Self-Employment and Labor Market Frictions," *Management Science*, 57 (11), 1999-2017.
- Barbarino, Alessandro, & Boyan Jovanovic, 2007. "Shakeouts and Market Crashes," *International Economic Review*, 48 (2), 385-420.
- Barney, Jay, 1991. "Firm Resources and Sustained Competitive Advantage," *Journal of Management*, 17 (1), 99-120.
- Berchicci, Luca., Andrew King, and Christopher L. Tucci. 2011. Does the apple always fall close to the tree? The geographical proximity choice of spin-outs. *Strategic Entrepreneurship Journal*, 5: 120–136.
- Bhaskarabhatla, Ajay, & Steven Klepper, 2013. "Latent Submarket Dynamics and Industry Evolution: Lessons from the U.S. Laser Industry," Working paper, Erasmus University and Carnegie Mellon University.
- Bhide, Amar V., 2000. *The Origin and Evolution of New Businesses*. Oxford University Press, Oxford, UK.
- Boeker, W. and Fleming, B. (2010), Parent firm effects on founder turnover: parent success, founder legitimacy, and founder tenure. *Strategic Entrepreneurship Journal*, 4: 252–267
- Boldrin, Michele, & David Levine, 2008. *Against Intellectual Monopoly*. Cambridge University Press, Cambridge, Massachusetts.
- Braguinsky Serguey, Steven Klepper, & Atsushi Ohyama, 2012. "High-Tech Entrepreneurship," *Journal of Law and Economics*, 55 (4), 869-900.
- Braguinsky Serguey, & Steven Klepper, 2009. "Worker Mobility and Growth: The Goose that Laid the Golden Eggs," In Alexei Monsarat & Kiron K. Skinner, eds., *Renewing Globalization and Economic Growth in a Post-Crisis World*, Carnegie Mellon University Press, Pittsburgh, Pennsylvania, 29-31.
- Brittain, Jack W., & John Freeman, 1986."Entrepreneurship in the Semiconductor Industry," Mimeo.
- Buenstorf, Guido, & Steven Klepper, 2009. "Heritage and Agglomeration: The Akron Tyre Cluster Revisited," *Economic Journal*, 119, 705-733

- Campbell, Benjamin A., Martin Ganco, April M. Franco, & Rajshree Agarwal, 2012. "Who Leaves, Where To, and Why Worry? Employee Mobility, Employee Entrepreneurship, and Effects on Source Firm Performance," *Strategic Management Journal*, 33 (1), 65-87.
- Carias, Cristina, & Steven Klepper, 2010. "Entrepreneurship, the Initial Labor Force, and the Location of New Firms," Working paper, Carnegie Mellon University.
- Carlton, Dennis W., 1979. "Why New Firms Locate Where They Do: an Economic Model," in W.C. Wheaton, ed., *Heterogeneous Movements and Regional Growth*, The Urban Institute, Washington, D.C. 13-45.
- Carlton Dennis W., & Jeffrey M. Perloff, 2004. *Modern Industrial Organization*. Fourth Edition, Pearson, Addison Wesley.
- Carnahan, Seth, Rajshree Agarwal, & Benjamin A. Campbell, 2012. "Heterogeneity in Turnover: The Effect of Relative Compensation Dispersion of Firms on the Mobility and Entrepreneurship of Extreme Performers," *Strategic Management Journal*, 33 (12), 1411-1430.
- Carroll, Glenn R., Lyda S. Bigelow, Marc-David L. Seidel, & Lucia B. Tsai, 1996. "The Fates of *De Novo* and *De Alio* Producers in the American Automobile Industry, 1885-1991," *Strategic Management Journal*, 17 (S1), 117-137.
- Carroll, Glenn, R., & Hannan, Michael T., 2000. *Demography of Corporations and Industries*, Princeton University Press, Princeton, New Jersey.
- Caves, Richard, E. "Industrial Organization and New Findings on the Turnover and Mobility of Firms," *Journal of Economic Literature*, 36 (4), 1947-1982.
- Chen, P.-L., Williams, C. & Agarwal, R. 2012. Growing pains: Pre-entry experience and the challenge of transition to incumbency. *Strategic Management Journal*, 33: 252–276
- Chesbrough, Henry, 1999. "Arrested Development: The Experience of European Hard Disk Drive Firms in Comparison With US and Japanese Firms," *Journal of Evolutionary Economics*, 9 (3), 287-329.
- Cheyre, Cristobal, Steven Klepper, & Francisco Veloso, forthcoming. "Spinoffs and the Mobility of the U.S. Merchant Semiconductor Inventors," *Management Science*.
- Christensen, Clayton M., 1997. *The Innovator's Dilemma*, Harvard Business School Press, Cambridge, Massachusetts.
- Christensen, Clayton M., 1993. "The Rigid Disk Drive Industry: A History of Commercial and Technological Turbulence," *Business History Review*, 67, 531-588.

- Cohen, Wesley M., & Steven Klepper, 1996b. "Firm Size and the Nature of Innovation within Industries: The Case of Process and Product R&D," *Review of Economics and Statistics*, 78 (2), 232-243.
- Cohen, Wesley M., & Steven Klepper, 1996a. "A Reprise of Size and R&D," *Economic Journal*, 106 (July), 925-951.
- Cohen, Wesley M., & Steven Klepper, 1992. "The Anatomy of Industry R&D Intensity Distributions," *American Economic Review*, 82 (4), 773-799.
- Evans, David, S. & Linda S. Leighton, 1989. "Some Empirical Aspects of Entrepreneurship," *American Economic Review*, 79 (3), 519-535.
- Franco, April, M., MB Sarkar, Rajshree Agarwal, & Raj Echambadi, 2009. "Swift and Smart: The Moderating Effects of Technological Capabilities in the Market Pioneering-Firm Survival Relationship," *Management Science*, 55 (11), 1842-1860.
- Franco, April M., & Darren Filson, 2006. "Spin-outs: Knowledge Diffusion Through Employee Mobility," *Rand Journal of Economics*, 37 (4), 841-860.
- Franke, N., & Shah, S. 2003. How communities support innovative activities: an exploration of assistance and sharing among end-users. *Research policy*, 32(1), 157-178.
- Garber, Steven, & Steven Klepper, 1980. "Extending the Classical Normal Errors-in-Variables Model," *Econometrica*, 48 (6), 1541-1546.
- Ganco, Martin, 2013. "Gutting the Gordian Knot: The Effect of Knowledge Complexity on Employee Mobility and Entrepreneurship," *Strategic Management Journal*, 34 (6), 666-686.
- Ganco Martin, Rajshree Agarwal, Rosemarie H. Ziedonis, forthcoming. "More Stars Stay, but the Brightest Ones Still Leave: Job Hopping in the Shadow of Patent Enforcement," *Strategic Management Journal*.
- Garmaise, Mark, J. 2011. "Ties that Truly Bind: Noncompetition Agreements, Executive Compensation, and Firm Investment," *Journal of Law, Economics, and Organization*, 27 (2), 376-425.
- Garvin, David, 1983. "Spin-offs and the New Firm Formation Process," *California Management Review*, 25 (1), 3-20.
- Geroski, Paul A. "What Do We Know About Entry?" *International Journal of Industrial Organization*, 13 (4), 421-440.
- Gilson, Richard J., 1999. "The Legal Infrastructure of High Technology Industrial Districts: Silicon Valley, Route 128, and Covenants Not to Compete," *New York University Law Review*, 74, 575-629.

- Golman, Russell, & Steven Klepper, 2013. "Spinoffs and Clustering," Working paper, Carnegie Mellon University.
- Gort Michael & Steven Klepper. "Time Paths in the Diffusion of Product Innovations." *Economic Journal*, 92, September 1982, 630-653.
- Gort Michael & Richard Wall. "The Evolution of Technologies and Investment in Innovations." *Economic Journal*, 96, September 1986, 741-757.
- Hall, Bronwyn H., & Rosemarie H. Ziedonis, 2001. "The Patent Paradox Revisited: An Empirical Study in the U.S. Semiconductor Industry, 1979-1995," *Rand Journal of Economics*, 32 (1), 101-128.
- Hamilton, Barton, 2000. "Does Entrepreneurship Pay? An Empirical Analysis of the Returns to Self-Employment," *Journal of Political Economy*, 108 (3), 604-631.
- Hellman, Thomas, 2007. "When Do Employees Become Entrepreneurs?" *Management Science*, 53 (6), 919-933.
- Jaffe, Adam B., 2000. "The US Patent System in Transition: Policy Innovation and the Innovation Process," *Research Policy*, 29 (4), 531-557.
- Jovanovic, Boyan, 2004. "Pre-producers," NBER Working Paper, 10771, Cambridge, Massachusetts.
- Jovanovic, Boyan, 1998. "Michael Gort's Contribution to Economics," *Review of Economic Dynamics*, 1, 327-337.
- Jovanovic, Boyan, & Chung-Yi Tse, 2010. "Entry and Exit Echoes," *Review of Economic Dynamics*, 13, 514-536.
- Jovanovic, Boyan, & Glenn MacDonald, 1994. "The Life Cycle of a Competitive Industry," *Journal of Political Economy*, 102 (2), 322-347.
- King Andrew A., & Christopher Tucci, 2002. "Incumbent Entry into New Market Niches: The Role of Experience and Managerial Choice in the Creation of Dynamic Capabilities," *Management Science*, 48 (2), 171-186.
- Klepper, Steven, 2013a. Interview recorded by Serguey Braguinsky on May 20, 2013.
- Klepper, Steven, 2013b. *Experimental Capitalism*. Unpublished manuscript.
- Klepper, Steven, 2002a. "Firm Survival and the Evolution of Oligopoly," *Rand Journal of Economics*, 33 (1), 37-61.
- Klepper, Steven, 2002b. "The Capabilities of New Firms and the Evolution of the US Automobile Industry," *Industrial and Corporate Change*, 11 (4), 645-666.
- Klepper, Steven, 2001. "Employee Startups in High-Tech Industries," *Industrial and Corporate Change*, 10 (3), 639-674.

- Klepper, Steven, 1996. "Entry, Exit, Growth, and Innovation Over the Product life Cycle," *American Economic Review*, 86 (3), 562-583.
- Klepper, Steven, & Peter Thompson, 2010. "Disagreements and Intra-industry Spinoffs," *International Journal of Industrial Organization*, 28, 526-538.
- Klepper, Steven, & Peter Thompson, 2006. "Submarkets and the Evolution of Market Structure," *Rand Journal of Economics*, 37 (4), 861-886.
- Klepper, Steven, & Sally Sleeper, 2005. "Entry by Spinoffs," *Management Science*, 51, 1291-1306.
- Klepper, Steven & Kenneth L. Simons, 2000. "The Making of an Oligopoly: Firm Survival and Technological Change in the Evolution of the U.S. Tire Industry," *Journal of Political Economy* 108 (4), 728-760.
- Klepper, Steven, & Elizabeth Graddy, 1990. "The Evolution of New Industries and the Determinants of Market Structure," *Rand Journal of Economics*, Vol. 21 (1), 27-44.
- Klepper, Steven & Leamer, Edward E., 1984. "Consistent Set of Estimates for Regressions with Errors in All Variables," *Econometrica*, 52 (1), 163-183.
- Krugman, Paul, 1991. "Increasing Returns and Economic Geography," *Journal of Political Economy*, 99 (3), 483-499.
- Kuznets, Simon, 1930. *Secular Movements in Production and Prices: Their Nature and their Bearing upon Cyclical Fluctuations*, Houghton Muffin, Boston, Mass. and New York.
- Marshall, Alfred, 1890. *Principles of Economics*. First edition, Macmillan, London.
- Robert P. Merges & Richard R. Nelson, 1990. "On the Complex Economics of Patent Scope," *Columbia Law Review*, 90 (4), 839-916.
- Marx, Matt, Deborah Strumsky, & Lee Fleming, 2009. "Noncompetes & Inventor Mobility: Specialists, Stars, & the Michigan Experiment," *Management Science*, 55 (6), 875-889.
- McGahan, Anita & Brian S. Silverman. "How Does Innovative Activity Change as Industries Mature?" *International Journal of Industrial Organization*, 19 (7), 2001, 1141-1160.
- Mitchell, Will, 1989. "Where and When? Probability and Timing of Incumbents' Entry into Emerging Industrial Subfields," *Administrative Science Quarterly*, 34 (2), 208-230.
- Mitchell, Will, 1991. "Dual Clocks: Entry Order Influences on Incumbent and Newcomer Market Share and Survival When Specialized Assets Retain Their Value," *Strategic Management Journal*, 12 (2), 85-100.

- Moeen, Mahka, & Rajshree Agarwal, 2014. Incubation of an Industry and Heterogeneous Modes of Value Capture: Evidence from Agricultural Biotechnology, University of Maryland Working Paper.
- Moore, Gordon, & Kevin Davis, 2004. "Learning the Silicon Valley Way," In Timothy Bresnahan and Alfonso Gambardella, eds., *Building high-tech clusters: Silicon Valley and beyond*, Cambridge University Press, Cambridge, 7-39.
- Murmann, Johann Peter, 2003. *Knowledge and Competitive Advantage*. Cambridge University Press.
- Nelson, Richard R., 1994. "The Co-evolution of Technology, Industrial Structure, and Supporting Institutions," *Industrial and Corporate Change*, 3 (1), 47-63.
- Nelson, Richard R., 1991. "Why Do Firms Differ, and How Does It Matter?" *Strategic Management Journal*, 12 (S2), 61-74.
- Nelson, Richard R., & Sidney G. Winter, 1982. *An Evolutionary Theory of Economic Change*. Harvard University Press, Cambridge, Massachusetts.
- Pakes Ariel, & Schmucl Nitzan, 1983. "Optimal Contracts for Research Personnel, Research Employment, and the Establishment of "Rival" Enterprises," *Journal of Labor Economics*, 1 (4), 345-365.
- Phillips, D. J. 2002. A genealogical approach to organizational life chances: The parent-progeny transfer among Silicon Valley law firms, 1946-1996. *Administrative Science Quarterly*, 47(3): 474-506.
- Porter, Michael E., 1991. "Towards a Dynamic Theory of Strategy," *Strategic Management Journal*, 12 (S2), 95-117.
- Qian, L., Agarwal, R., & Hoetker, G. 2012. Configuration of value chain activities: The effect of pre-entry capabilities, transaction hazards, and industry evolution on decisions to internalize. *Organization Science*, 23(5), 1330-1349.
- Samila, Sampsa, & Olav Sorensen, 2011. "Noncompete Covenants: Incentives to Innovate or Impediments to Growth?" *Management Science*, 57 (3), 425-438.
- Samuelson, Paul A., 1947. *Foundations of Economic Analysis*. Harvard University Press, Cambridge, Massachusetts.
- Sarangee, K. R. and Echambadi, R. (2013), Firm-Specific Determinants of Product Line Technology Strategies in High Technology Markets. *Strategic Entrepreneurship Journal*
- Shah, Sonali, & A. Torrance, 2013. "Reconceptualizing the PHOSITA: Reexamining Non-obviousness in light of recent developments in innovation research," Working paper, University of Washington..

- Silverman, Brian S., 2009. "Industry Evolution (bibliography)," Strategy Research Initiative.
- Sauermann, Henry, & Michael Roach, 2013. "The Entrepreneurial Intentions of Founders and Joiners," Working Paper, Georgia Institute of Technology.
- Saxenian, AnnaLee, 1991. "The Origins and Dynamics of Production Networks in Silicon Valley," *Research Policy*, 20 (5), 423-437.
- Shaver J. Myles, & F. Flyer, 2000. Agglomeration economies, firm heterogeneity, and foreign direct investment in the United States. *Strategic Management Journal* 21(12), 1175–1193.
- Sutton, John, 1997. "Gibrat's Legacy," *Journal of Economic Literature*, 35 (1), 40-59.
- Thompson Peter, & Jing Chen, 2011. "Disagreements, Employee Spinoffs, and the Choice of Technology," *Review of Economic Dynamics*, 14, 455-474.
- Tripsas, M. 1997. Unraveling the process of creative destruction: Complementary assets and incumbent survival in the typesetter industry," *Strategic Management Journal*, 18(s 1), 119-142.
- Utterback, James M., & William J Abernathy, 1975. "A Dynamic Model of Process and Product Innovation," *Omega*, 3 (6), 639-656.
- Utterback, James M., & Fernando F. Suarez, 1993. "Innovation, Competition, and Industry Structure," *Research Policy*, 22 (1), 1-21.
- Wezel, F. C., Cattani, G., & Pennings, J. M. 2006. Competitive implications of interfirm mobility. *Organization Science*, 17(6): 691-709.
- Winter, Sidney, 1984. "Schumpeterian Competition in Alternative Technological Regimes," *Journal of Economic Behavior and Organization*, 5 (3-4), 287-320.
- Ziedonis, Rosemarie H., 2004. "Don't Fence Me In: Fragmented Markets for Technology and the Patent Acquisition Strategies of Firms," *Management Science*, 50 (6), 804-820.